

Deactivation and Decommissioning Focus Area

QUARTERLY REPORT

October — December 2001 Activities



On the Cover

(left to right)

On the cover are the **Russian Isotopic Identification Device (IDD)** and **Gamma Locator Device (GLD)**. The IDD is an integral system of the GLD. The two were successfully demonstrated as part of the Idaho National Engineering and Environmental Laboratory Fuel Storage Canals and Underwater and Underground Facilities LSDDP project.

RaceScan was demonstrated at the LANL TRU LSDDP for the improvement of communication between workers.

The Deactivation and Decommissioning Focus Area (DDFA) is updating its databases. Please assist us by filling out the form below so we can better serve you. Please print clearly and return this form by May 15, 2002

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Please respond by May 15, 2002

This form is also available on our website at <http://www.netl.doe.gov/dd>.
Download and complete the form and email it to rebecca.friend@ri.netl.doe.gov



The purpose of this document is to provide an overview of the Deactivation and Decommissioning Focus Area (DDFA) and to update readers on the program's current activities. It presents a synopsis of the current program status and recent accomplishments, along with overviews of planned activities, program issues, and opportunities. Quarterly reports are distributed to U.S. Department of Energy (DOE) headquarters and operations office managers, site personnel, site operating contractors, technology developers, principal investigators, regulators, and other stakeholders. Issued four times a year, the DDFA quarterly reports summarize the activities of each quarter. Quarterly reports and further information about the DDFA are found on the World Wide Web at <http://www.netl.doe.gov/dd>. Technologies are identified by their discrete tracking numbers within the Technology Management System (TMS) operated by DOE's Office of Science and Technology (OST). TMS is found on the web at <http://tms.em.doe.gov> and provides access to information about OST programs, technologies, and linkages to Office of Environmental Management (EM) problems.

D&D Focus Area Contacts

Focus Area Lead

Robert C. Bedick, DOE-NETL
304-285-4505, robert.bedick@netl.doe.gov

Interim DDFA Headquarters Lead

Charles Nalezny, DOE-HQ
301-903-1742, charles.nalezny@em.doe.gov

NETL Senior Management and Technical Advisor

Steve Bossart, DOE-NETL
304-285-4643, steven.bossart@netl.doe.gov

Environmental Management and Defense Projects Division Director

John Murphy, DOE-NETL
304-285-4166, john.murphy@netl.doe.gov

NETL Project Managers

George Bellas, DOE-NETL
412-386-6184, george.bellas@netl.doe.gov
Richard Bush, DOE-NETL
412-386-6426, richard.bush@netl.doe.gov
Cliff Carpenter, DOE-NETL
304-285-4041, cliff.carpenter@netl.doe.gov
Madhav Ghate, DOE-NETL
304-285-4135, madhav.ghate@netl.doe.gov
Ed Klunder, DOE-NETL
412-386-4678, edgar.klunder@netl.doe.gov
Vijendra Kothari, DOE-NETL
304-285-4579, vijendra.kothari@netl.doe.gov
Jagdish Malhotra, DOE-NETL
304-285-4053, jagdish.malhotra@netl.doe.gov
David Schwartz, DOE-NETL
412-386-6714, david.schwartz@netl.doe.gov
Harold Shoemaker, Ph.D., DOE-NETL
304-285-4715, harold.shoemaker@netl.doe.gov
Ron Staubly, DOE-NETL
304-285-4991, ron.staubly@netl.doe.gov
David Szucs, DOE-NETL
412-386-4899, david.szucs@netl.doe.gov

D&D Updates and Reports

Comments, address changes, address corrections
Danielle Blair, SAIC
304-598-3709, danielle.m.blair@saic.com

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▼ Idaho National Engineering and Environmental Laboratory's (INEEL) Large-Scale Demonstration and Deployment Project (LSDDP) Has Major Impact on Department of Energy's (DOE) Decommissioning Projects

In its final project report for the INEEL Fuel Storage Canals and Underwater and Underground Facilities LSDDP, INEEL claimed that the improved technologies demonstrated in the LSDDP will save them over \$39M in the next ten years by use in their decommissioning projects. Seventeen improved decontamination and decommissioning (D&D) technologies were demonstrated in the National Energy Technology Laboratory (NETL)-sponsored LSDDP. The technologies have been deployed 69 times at sites other than the demonstration location and ten technologies have become the new baseline technologies used at INEEL on its D&D projects. As a result of the project, 16 technology needs have been removed from INEEL's list of D&D needs. Technologies demonstrated in the INEEL LSDDP, which have and will continue to impact decommissioning projects at INEEL and other DOE sites, include the lead paint analyzer, global positioning radiometric scanner, remote underwater characterization system, soft-sided waste containers, PCB analyzer, ultralift motorized handcart, surveillance and measurement system, automatic locking scaffold, remote wall decontamination technology, and paint scaler.

▼ Industry Partnerships for Environmental Science and Technology Conference Held October 30 – November 1, 2001

A technical exchange conference, sponsored by NETL, was held at Morgantown, West Virginia. This technical conference provided a forum for private sector organizations, academic institutions, potential users of technologies at DOE sites, and other interested parties to review the status of environmental and waste management technologies being developed and deployed under the

Office of Environmental Management's (EM) Office of Science and Technology (OST) Program through NETL. OST Deputy Assistant Secretary Gerald Boyd was a keynote speaker. He stresses that EM continues to emphasize industry partnerships in research and development that lead to field deployment of innovative technologies to solve DOE's cleanup problems. This conference addressed the accomplishments and barriers affecting businesses and laid the groundwork for future technology development and deployment partnerships. The main highlight of this conference was discussed in various technical sessions as to how the industry developers, DOE sites, regulators, and stockholders can work together to solve environmental problems at the Nation's weapon complexes. About 165 people from private industry, contractors, nuclear power utilities, and government agencies participated in the conference.

▼ Nochar PetroBond® Oil Solidification Products Requested for World Trade Center Cleanup

Nochar Incorporated of Indianapolis, Indiana was contacted by the Federal Emergency Management Agency (FEMA) to provide assistance with the World Trade Center cleanup. In the World Trade Center tragedy, thousands of gallons of jet fuel were spilled, but not all was ignited. Additionally, other hydrocarbon materials are

1.0

HIGHLIGHTS



Nochar absorbent polymer material

also present and become a hazard under such devastation. FEMA's intended use for the Nochar absorbent polymer material is to isolate and treat hazardous material and to protect workers during cutting and welding operations. Upon receiving the call, Nochar readied for shipment a large supply of their hydrocarbon solidification technology material (about 1000 units in the form of pillow and boom products that can be directly placed on hazards, such as puddles of jet fuel) to the World Trade Center and Pentagon emergency services. Nochar representatives have worked closely with Mound over the last three years through the Mound Tritium D&D LSDDP and the TRU Waste Oil Solidification Accelerated Site Technology Deployment (ASTD) Project. Nochar produces high technology polymers that will absorb and solidify/stabilize liquid hydrocarbons, such as oil and jet fuel, turning them into non-explosive, rubber-like compounds that are safe to handle and dispose.

▼ DDFA Co-Hosts Basic Science Kickoff Meeting

On November 27–28, 2001, DDFA and the EM Science Program (EMSP) hosted a workshop to highlight the new basic science awards in the area of deactivation and decommissioning. The workshop was held at Oak Ridge National Laboratory (ORNL) and featured presentations by 14 principle investigators. The purpose of the meeting was to introduce the researchers to EM end users and problem holders, and to begin dialogs that may eventually result in direct application of the research being conducted. In addition to the presentations and open discussion session, attendees were invited to tour three Oak Ridge facilities: a pilot-scale uranium reprocessing facility, a research reactor facility, and the robotics laboratory. See the table on page 7 for projects presented.

▼ New ASTD Projects Awarded

The following four new ASTD Projects were awarded for FY2002:

Technology Deployment for the Implementation of Improved Decontamination and Decommission Instrumentation at Rocky Flats

OST and the DDFA have partnered with the Rocky Flats Environmental Technology Site (RFETS) to support an ASTD project whose goal is to achieve Site closure in FY2006. Currently, one nuclear facility has been demolished and five others are in various stages of deactivation, decontamination, and decommissioning. Work is to continue in two areas; size reduction and avoidance of size reduction through decontamination. However, it is clear that improved instrumentation for characterization offers the best opportunity for further cost and schedule reductions.

This project provides for the procurement, installation, and deployment of a suite of technologies to upgrade instrumentation on site. The technologies chosen were based on proven history as well as expected enhanced performance over current baseline methods. The six technologies are:

- Remote Radiological Sampling
- Real-Time Beryllium Air Monitoring
- Beryllium Swipe Monitor
- Direct Read Beryllium Swipes and Filters
- External Measurement for Surface Contaminated Objects Characterization
- Remote Special Nuclear Material Measurement in the 371 Central Storage Vault

The benefits that will be derived from deploying these technologies support the comprehensive processes needed to increase the performance of radiological measurements and accelerate baseline D&D activities to meet the FY2006 closure schedule for Rocky Flats.

The total cost of these instruments is estimated at over \$1.1M. The site will support this project with over \$2.2M in leveraged funds for technology deployment. Therefore, the total estimated cost of the project is approximately \$3.4M.

NEW BASIC SCIENCE AWARDS IN THE AREA OF DEACTIVATION AND DECOMMISSIONING

Project Title	Performing Organization	Principal Investigator
Assessing the State and Distribution of Radionuclide Contaminants in Concrete: An Experimental and Modeling Study of the Dynamics of Contamination	Lawrence Livermore National Laboratory	Brian Viani 925-423-2001
Field Portable Microchip Analyzer for Airborne and Surface Toxic Metal Contamination	Naval Research Laboratory	Greg Collins 202-404-3337
Remote Manipulation for Deactivation and Decommissioning Exhibiting Tele-Autonomy and Tele-Collaboration	Argonne National Laboratory	Thomas Yule 630-252-6740
Design and Sensor-Based Control for Hyper-Redundant Mechanisms	Carnegie Mellon University	Howie Choset 412-268-2495
Physico-Chemical Dynamics of Nanoparticle Formation during Laser Deactivation and Characterization	Oak Ridge National Laboratory	Meng-Dawn Cheng 865-241-5918
Alternative Ionization Methods for Particle Mass Spectrometry	Oak Ridge National Laboratory	William Whitten 865-574-4921
Bio-Chemo-Opto-Mechanical (BIO-COM) Sensors for Real-Time Characterization	Oak Ridge National Laboratory	T. Thundat 865-574-6201
Innovative Laser Ablation Technology For Surface Decontamination	Oak Ridge National Laboratory	Winston C.H. Chen 865-574-5895
Multi-Optimization Criteria-Based Robot Behavioral Adaptability and Motion Planning	Oak Ridge National Laboratory	Francois G. Pin 865-574-6130
Image-Based Visual Serving for Robotic Systems: A Nonlinear Lyapunov-Based Control	Oak Ridge National Laboratory	Warren E. Dixon 865-574-9025
Hybrid Actuators for Enhanced Automation in D&D Systems Tasks	Oak Ridge National Laboratory	John F. Jansen 865-574-8154
Development of Biodegradable Isosaccharinate-Containing Foams for Deactivation of Actinides: Thermodynamic and Kinetic Reactions Between Isosaccharinate and Actinides on Metal and Concrete Surfaces	Pacific Northwest National Laboratory	Dhanapat Rai 509-373-5988
Contaminant-Organic Complexes: Their Structure and Energetics in Surface Deactivation Processes	Pacific Northwest National Laboratory	Calvin C. Ainsworth 509-375-2670
Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces (Ongoing EMSP Project)	University of California, Los Angeles	Robert F. Hicks 310-206-6865

A preliminary estimate of the savings that may accrue from this deployment is over \$400K in the first year and in excess of \$100M by Site closure. In addition, employing the instruments specified will enhance worker safety, increase productivity, improve D&D material processing, lower life-cycle costs, and ultimately accelerate the closure of the Site resulting in substantial additional savings.

Preparation of Problem Process Systems for D&D at the Miamisburg and Columbus Environmental Management Projects

The DDFA is providing Mound with approximately \$350K to fund deployment of two innovative technologies to prepare problematic process systems for D&D. These facilities present problems involving process residue in tanks and process system components. The WD Building Complex was formerly a treatment facility for low-specific-activity radioactive waste. Building 38 was used for extraction and experiments with plutonium and other radionuclides. It contains a large amount of contaminated piping and ductwork and several gloveboxes.

This ASTD will use Urethane Foam Void Filling (Foaming) and Passive Aerosol Generation (Fogging) to expedite D&D of these problem areas. Prior demonstration of Foaming yielded a high productivity rate and the desired structural properties, and the process was judged to offer the greatest advantage over segmentation for vessels with multiple chambers, baffles, tubing, or other forms of internal obstructions. Fogging creates a fine mist of organic material that is slowly introduced into an area, condenses on all surfaces, and encapsulates airborne contamination. This ASTD will identify and apply the best coating material using Fogging to stabilize contamination in inaccessible areas of process systems prior to D&D.

Technology to Enable Monolithic Disposal of Hot Cells at Hanford

Hanford's vision to complete restoration of the Columbia River Corridor by 2012 requires accelerating the disposition of the 327 Building's large hot cells (60-150 tons). To meet the 2012 vision, Hanford will

implement a new strategy that consists of deploying a suite of characterization technologies such that decontamination and material handling requirements as well as secondary waste generation are minimized. Recent advances in nondestructive assay (NDA) techniques and selective use of dry decontamination methods will be employed in order to prove that "less than transuranic (TRU)" (less than 100 nanocuries/gram) levels can be achieved on the 327 Building hot cells. Decontamination will be performed only where needed to get below TRU designation levels. If successful and less than TRU designation can be achieved and verified, this strategy will allow removal of the 327 Building hot cells as monolithic units and individual waste packages. This represents a significant departure from the current technical baseline, greatly minimizes secondary waste, and results in a projected cost savings of \$10.3M and return-on-investment of 276%.

Pollution Prevention in D&D at INEEL

By their nature, D&D activities generate waste that must be recycled, stored, or destroyed. More than 64,000 cubic yards of low-level waste and 1,200 cubic yards of mixed waste will be generated during the INEEL's lifetime, assuming use of conventional D&D techniques. Dealing with radioactive and hazardous materials during D&D activities is expensive and time-consuming. Innovative approaches are needed to reduce the volume of waste generated, reduce costs, and accelerate schedules. This ASTD project is targeting pollution prevention during D&D work in the areas of facility characterization, sludge treatment, dust and contamination control, and concrete demolition.

The Pollution Prevention in D&D ASTD project will use new, existing technologies to minimize waste, prevent pollution, and save time and money in the performance of the typical D&D tasks of remote characterization, mixed waste sludge treatment, dust and contamination control, and concrete demolition. The following technologies are proven, commercially available, and highly applicable to the D&D tasks.

- Russian Gamma Locator Device and Isotopic Identification Device (GLD/IID) for remote characterization
- LEADX® (or a similar product) for immobilization of heavy metals for mixed-waste sludge treatment
- Passive Aerosol Generator (Fogging) for contamination control
- Sure Strike Rock Breaker (Hammerhead) for concrete demolition

Deployment of these technologies will collectively result in less waste generation and lower D&D costs while at the same time accomplishing work faster and more safely. Cost/benefit estimates for deployment of these technologies yielded a life cycle cost savings of more than \$9M.

2.0

PROJECT SUMMARY TABLE

The following table summarizes the Technical Task Plans for the D&D Focus Area Core Program and related Crosscutting and Industry Program contracts. Project descriptions follow in subsections 2.1 through 2.5 and are organized by the work breakdown structure (WBS) element listed here.

TTP Number	WBS Element	Project Name	Page
AL08DD2I	Demonstrations and Industry Approaches	LSDDP: LANL TRU Waste Characterization, Decontamination, and Disposition	12
OH08DD2I	Demonstrations and Industry Approaches	LSDDP: Mound Tritium Facilities D&D	13
ID08DD2I	Demonstrations and Industry Approaches	LSDDP: INEEL Fuel Storage Canals and Associated Facilities D&D	16
AL11DD3I	Demonstrations and Industry Approaches	LSDDP: LANL Tritium Facilities D&D	17
ID01DD1I	Demonstrations and Industry Approaches	LSDDP: INEEL and Associated Facilities Fuel Pools and Material Dispositioning	18
OH01DD1I	Demonstrations and Industry Approaches	LSDDP: WVDP Hot Cell D&D	19
RL08DD2I	Demonstrations and Industry Approaches	Canyon Disposition Initiative	20
RF09DD2I RF08SD10 RF09DD6I	Demonstrations and Industry Approaches	Rocky Flats Environmental Technology Site D&D Initiative and Associated ASTD Projects	20
OH21DD3I	Demonstrations and Industry Approaches	Mound Facilities Long-Term Stewardship Initiative	23
SR09DD6I	Demonstrations and Industry Approaches	ASTD: Highly Selective Nuclide Removal System	24
OH19DD6I	Demonstrations and Industry Approaches	ASTD: Integrated Excavation Control System	24
RL09DD6I	Demonstrations and Industry Approaches	ASTD: Remote Size Reduction for Large Hot Cell Deactivation	25
AL08SD10	Demonstrations and Industry Approaches	ASTD: LANL Decontamination and Volume Reduction System	26
NV09DD6I	Demonstrations and Industry Approaches	ASTD: Oversize TRU Waste Laser Cutting System	26
OH10DD2I	Demonstrations and Industry Approaches	ASTD: Reducing, Reusing, and Recycling Concrete and Segmenting Plate Steel Using a Universal Demolition Processor	27

TTP Number	WBS Element	Project Name	Page
OH10DD31	Demonstrations and Industry Approaches	ASTD: Improved Measurement and Monitoring Systems	28
OH00DD31	Demonstrations and Industry Approaches	ASTD: Intrusive and Non-Intrusive Characterization through Concrete Walls and Floors	28
NV01DD32	Demonstrations and Industry Approaches	ASTD: MARSSIM Innovative Characterization at Nevada Test Site	30
SR01DD22	Demonstrations and Industry Approaches	ASTD: Demonstration & Deployment of Remotely Operated Size Reduction System	30
	Demonstrations and Industry Approaches	D&D Consortium	31
Multiple Projects	Demonstrations and Industry Approaches	Florida International University	32
Multiple Projects	Demonstrations and Industry Approaches	International Agreement with AEA Technology	33
	Demonstrations and Industry Approaches	Small Business Innovation Research Program	34
NT40768	Facility Characterization	Technology for Real-Time Measurement of Surface and Airborne Beryllium	37
FT06IP01	Facility Decontamination	Technology Deployment for Asbestos Destruction	39
Multiple Projects	Facility Dismantlement and Material Disposition	Robotics Crosscutting Program	40
FT01AR01	Facility Dismantlement and Material Disposition	Electro-Hydrostatic Transmission and Control Technology for Modular D&D Manipulators	41
FT01AR01	Facility Dismantlement and Material Disposition	Transmission-Based Electrical Servoactuators	41
DE-AC21-93 MC30179	Worker Safety	Protective Clothing Based on Permselective Membrane and Carbon Absorption	43

2.1

DEMONSTRATION AND INDUSTRY APPROACHES

▼ Los Alamos National Laboratory (LANL) Transuranic (TRU) Waste Characterization, Decontamination, and Disposition Large Scale Demonstration and Deployment Project (LSDDP)

Objective and Scope: The LANL TRU Waste Characterization, Decontamination, and Disposition LSDDP addresses the characterization, decontamination, and volume reduction of oversized metallic TRU waste currently in storage at TA-54, LANL's storage and disposal area. The LANL TRU LSDDP reflects the cooperative interest of industry, government, and academia to bring collaborative expertise and strength to the DOE TRU decontamination and decommissioning (D&D) program at LANL and elsewhere within the DOE complex. LANL currently has 1,500 cubic meters of TRU waste in inventory, stores 313 plutonium-contaminated gloveboxes in a 24,000-square-foot facility, and expects to generate another 2,500 cubic meters from ongoing operations in coming years.

The major objectives of this LSDDP are to:

- Identify technologies that are ready for deployment for the characterization, decontamination, and volume reduction of TRU waste/TRU contaminated metallic objects.
- Identify technologies that are ready for demonstration.
- Demonstrate those technologies with potential to reduce cost, risk, and schedule and that are amenable for direct field application at LANL and elsewhere in the DOE complex.
- To the extent possible, compare technologies side-by-side with baseline approaches to evaluate their advantages (cost, risk, and schedule) and to refine or validate baseline assumptions.
- Capitalize on the combined corporate management and technical strength of private industry, government, and academia.
- Demonstrate a leveraged funding pool of federal and private monies via cost sharing to address issues of national importance.
- Provide ready access to demonstration

results through an aggressive communication program.

Status and Accomplishments:

The following demonstrations have been completed: AeroGo Air Lift Pallet System (Tech ID 2396), Vehicle and Cargo Inspection System (VACIS) (Tech ID 2912), Mega-Tech Blade Plunging Cutter (Tech ID 2953), NT Vision System (Tech ID 3069), Mobile Characterization System (Tech ID 2959), RaceScan (Tech ID 3129), Fog and Strip (Tech ID 3143), and an electrochemical decontamination technology.



Vehicle and Cargo Inspection System (VACIS)

Current Reporting Period Activities:

The LSDDP project manager presented the project results at the LSDDP lessons learned meeting in West Valley, NY. DVRS and LSDDP representatives met with Environmental Alternatives, Inc. (EAI) personnel to discuss and review the Rocky Flats glovebox decontamination technologies for application at the Decontamination and Volume Reduction System (DVRS). An electrochemical decontamination technology was demonstrated during the current reporting period in a glovebox at TA-55 at LANL.

For more information:

<http://www-emtd.lanl.gov/LSDDP/DDtech.html>

Tech ID 2203

Jim Orban, DOE-AL

505-845-4421

jorban@doeal.gov

Steve Bossart, DOE-NETL

304-285-4643

steven.bossart@netl.doe.gov

▼ Mound Tritium D&D LSDDP

Objective and Scope The Mound Plant in Miamisburg, Ohio, began operations in 1948. The site's mission, originally to fabricate the neutron initiator for the atomic bomb, expanded to include research, development, and production of numerous nuclear and non-nuclear weapons components, production of radioisotopically fueled thermoelectric generators, and surveillance of nuclear weapons components.

The objective of the Mound Tritium Deactivation and Decommissioning LSDDP is to identify, demonstrate, and evaluate innovative technologies applicable to D&D of tritium facilities. D&D of Mound's surplus tritium facilities, the T and R/SW Buildings, provides a unique opportunity to compare, evaluate, and eventually execute innovative D&D technologies alongside baseline technologies in an ongoing project. The Mound LSDDP will identify and explore methods to improve worker safety while achieving cost and schedule savings. The project is expected to identify technologies that, when implemented in the Mound LSDDP, will produce significant savings compared to the \$57.8 million baseline. The results and successes of this demonstration project will benefit similar DOE facilities and projects.

The T Building is an underground, reinforced-concrete structure built in 1948 for the purification of polonium-210 used in nuclear weapons initiators. Later the facility was used to extract other radionuclides, house the plutonium verification facility, and store TRU materials. Facilities large enough to handle multi-kilogram quantities of tritium were added to the building. Current plans are to decontaminate T Building to allow potentially unrestricted public reuse by the year 2003. The SW Complex and one corridor of rooms in the adjacent R Building form the SW/R Complex. Four types of operations have been performed in these facilities to support nuclear weapons programs using tritium: component development, component evaluation operations, tritium recovery, and material analysis. To meet DOE's vision of completing the environmental restoration of the site by 2005, the SW/R Complex will be demolished, and contamination beneath the building will be removed.



The Mound Plant, Miamisburg, Ohio commenced operation in 1948.

The Mound LSDDP Integrating Contractor (IC) Team includes the following: Babcock & Wilcox of Ohio; Lawrence Livermore National Laboratory (LLNL); British Nuclear Fuels Limited (BNFL); Foster Wheeler; IT Corp; LANL; Westinghouse Savannah River; Princeton Plasma Physics Laboratory (PPPL); and FIU.

Status and Accomplishments:

Completed Demonstrations:

1. Portable Scintillation Counter (Tech ID 2311):

The Lumi-Scint portable scintillation counter is a portable, single-tube liquid scintillation counter that can be set to respond to the low-energy beta radiation emitted from tritium. It uses a single photomultiplier tube and manual sample chamber. The Lumi-Scint operates on an internal battery or 110 VAC. The unit can be obtained with a printer to produce hard copies of its electronically stored data.

2. Water Solidification (Tech ID 2312):

This technology uses a polymer-based absorbent, WaterWorks SP-400 that can be used to solidify aqueous waste. It is similar to other polymer-based absorbents that offer benefits over traditional solidification agents such as cement or Aquaset, the baseline solidification agent for the Mound facility. Benefits include the following: a high liquid-to-absorbent ratio; no mechanical mixing required to promote the absorption process; little to no volume increase in the waste after addition of the absorbent; and very high retention in the form of the gel-like material.

3. Oil Solidification (Tech ID 2313):

This contaminated oil solidification technology, Nochar PetroBond®, is a high-quality polymer offered by Nochar®, Inc.,

of Indianapolis, Indiana, and is specifically designed as a petroleum-based liquid absorbent. The Nochar PetroBond® absorbs very quickly with little increase in volume. The Nochar PetroBond® can be used for free-liquid control in storage, transport, and disposal of low-level radioactive waste.

4. Tritium Cleanup Cart (Tech ID 2974):



The Tritium Clean-Up Cart was demonstrated as part of the Mound LSDDP

The Tritium Cleanup Cart is a portable tritium processing system. Used as a stand-alone cart for scrubbing tritium effluent, it provides a scrubbing process based on catalytic oxidation of tritium. Tritiated water is collected on removable molecular sieve dryers, which can be

shipped as low-level waste below the 1080 curie "Type A" limit. The unit provides a projected decontamination factor of greater than 1000, with a process flow rate of 45 liters per minute. Design features include the following: mole sieve dryer beds configured in series with moisture monitors to prevent moisture breakthrough; process flow controllers in the main plumbing loop and air inlet system; process thermocouples, which provide process stream and enclosure over-temperature control; and an enclosure that can function as a ventilated hood during normal operating conditions, but also can be isolated when tritium concentrations inside the enclosure exceed the pre-selected control set point.

5. Pipe Cutting and Crimping System (Tech ID 2955):

The Pipe Cutting and Crimping System is a small, hand-held, battery-operated crimping tool manufactured by Burndy Products. This tool utilizes a separate hydraulic pump with a high-pressure hose connecting the pump to the crimping head. U-shaped dies are contained in the head for crimping. A battery-powered hydraulic pump or an electric-powered pump can be used to develop 10,000 pounds per square inch (psi) of pressure to the crimping head. Thirty crimping operations can be performed before recharging is needed. The small dimen-

sion and light weight make this tool very suitable for crimping in tight quarters.

6. TechXtract® Chemical Decontamination of Metals (Tech ID 1450):

TechXtract® is a contamination extraction technology that utilizes chemical formulations to remove contaminants from matrix surfaces and subsurfaces. Different chemical formulations are used for removal of specific contaminants from metal surfaces and subsurfaces. In this demonstration, the technology successfully decontaminated volumetrically contaminated stainless steel equipment. The demonstration showed greatly improved decontamination efficiency compared to the baseline method of decontamination using hydrogen peroxide.

7. Heavy Metals Removal from Mixed Waste Oils Using Self Assembled Monolayers on Mesoporous Supports (SAMMS) (Tech ID 1447):

The SAMMS technology was developed by Pacific Northwest National Laboratory (PNNL) for removal and stabilization of Resource Conservation and Recovery Act (RCRA) listed metals (i.e., lead, mercury, cadmium, silver, etc.) and for removal of mercury from organic solvents. The SAMMS material is based on self-assembly of functionalized monolayers on mesoporous oxide surfaces. The unique mesoporous oxide supports provide a high surface area, thereby enhancing the metal-loading capacity. SAMMS material has high flexibility in that it binds with different forms of mercury, including metallic, inorganic, organic, charged, and neutral compounds. It removes mercury both from organic wastes such as pump oils and from aqueous wastes.

8. Barter Process (Tech ID 3062):

The Equipment Reuse, Bartered Sale of Used Contaminated Equipment to a Commercial Company (Barter Process) was demonstrated. As a closure site, much of the DOE Miamisburg Environmental Management Project's (MEMP) equipment is planned for disposal. The Mound LSDDP team, instead of considering disposal as a first option, has demonstrated that there are numerous benefits to the reuse of equipment at another facility or company over disposal. They completed a process to transfer used,

tritium-contaminated equipment to a commercial company by means of a bartered sale agreement, to a Texas-based Nuclear Regulatory Commission (NRC) licensed pharmaceutical company. The Mound LSDDP team effectively applied the process knowledge and methodology developed by the DOE National Center of Excellence for Metals Recycle (NMR) in Oak Ridge to facilitate equipment reuse at many DOE sites. A Bartered Sale agreement was negotiated, and the first shipment of used equipment completed. Additional shipments will follow. As a result, DOE expects to avoid over \$400,000 in equipment disposal costs and an additional \$1 million by shortening the schedule for site closure.

9. Electret-Passive Environmental Radiation Monitor (E-PERM®) (Tech ID 2315):

The E-PERM® is a commercially available instrument designed to provide faster and less expensive means of determining the tritium contamination in air and on solid surfaces. For measurement of airborne tritium, the E-PERM® uses a chamber made of carbon filled polypropylene and a window made of thick carbon-coated Tyvek® material, which is highly transparent to water vapor. For tritium surface monitoring, the E-PERM® system is used in a windowless mode. A mesh, supplied by the manufacturer, is used over the surface of a contaminated object before deploying the electret ion chamber to prevent contamination of the chamber.

10. Waste Isolation Composite (WIC) (Tech ID 3061):

WIC is an ultra-high-strength composite material with high durability and low permeability that can be used for isolation or encapsulation of high-activity tritiated liquids. This is especially useful for disposal of liquid waste with high curie-content tritiated water. Structural integrity tests were completed and the composite's performance was satisfactory.

11. Fiber-Optic Tritium Detector and Quantifier (Tech ID 2956):

This technology, developed by McDermott Technologies, Inc., uses a fiber-optic bundle coupled to a photomultiplier

tube detector to measure low-energy beta radiation from radioactive decay of tritium. It allows the fiber bundle to be introduced directly in the liquid (oil or water) sample for tritium detection and quantification.

12. Liquid Scintillation Vial Shredder and Disposal (Tech ID 3066):

This technology developed as a follow-up to the successful demonstration and wide deployment of oil solidification (Tech ID 2313). The process has proven very successful for disposal of liquid scintillation counting (LSC) vials used for laboratory analysis. The technology uses a mechanical shredder to crush the vials containing scintillation cocktail. It captures the shredded vials in a net area and the scintillation cocktail in a drum for treatment with NOCHAR®N991. During the demonstration, five 55-gallon drums containing about 73,650 vials of LSC waste were processed. Following the successful demonstration, the shredder and disposal processes were deployed at Mound in June 2001.

13. TechXtract® Chemical Decontamination of Concrete (Tech ID 1450):

TechXtract® chemical treatment to remove surface (and potentially near-surface) contamination from concrete was conducted in a tritium laboratory at LLNL. Data were collected to measure the tritium-rebound effect and to measure performance of the technology for removing below-surface contamination. An additional application of the TechXtract® process was needed to eliminate the sources of rebounding contamination. Primarily this turned out to be migration from untreated floor areas adjacent to the test patch. The earlier crack source hypothesis appears less important. Success followed two thorough treatments of the entire lab floor space.

Current Reporting Period Activities:

Completed Demonstrations:

1. Tritium Concrete Characterization (Tech ID 3065):

The Tritium Concrete Characterization Process allows profiling of contamination in depth in floors, walls, and ceilings. The process uses a hollow core hammer drill that is coupled through a rotating seal to a vacuum line and sampling train. All of the particulates

generated from the drilling operation are removed by the high-flow vacuum system and are captured in a high efficiency particulate air (HEPA) filter cartridge. The particulates are then transferred to a sample vial and a field measurement of the contamination level is carried out in a portable liquid scintillation counter. The leach testing on radioactively contaminated samples initiated in mid-September has been completed.

2. Tritiated Monitoring System (TMS 2000) (Tech ID 2933):

The innovative technology demonstrated is a portable, hand-held, tritium-contamination detector capable of detecting tritium on a flat surface by direct contact, or measuring tritium activity on a smear by placing a smear in a special "drawer" on which the detector is placed over the smear. This detector is easily transported into the field to allow for quick turn-around time in the measuring of tritium contamination. The final phase of the demonstration involved operating the unit in a smear counting mode. The smear data has been analyzed and the data package compilation is expected to be completed in January.

Completed Deployments:

A major milestone in the disposal of Mound's tritiated waste oil was achieved in late September. One hundred (100) liters of tritiated waste oil (0.59 curies/liter) were solidified using the Nochar PetroBond® absorbent polymer (N990) and placed in five 22-gallon containers approved by the U.S. Department of Transportation and Nevada Test Site. The Nochar® N990 polymer solidified the tritiated waste oil flawlessly with a 1-to-1 weight ratio of oil to polymer. It meets all the regulatory requirements for disposal at the Nevada Test Site. The Mound tritiated oil waste is estimated at 1200-1500 gallons. In December, solidification of this waste stream resumed, with waste contamination of 2000 curies/liter. One hundred liters in four 22-gallon containers were treated, an improvement over the previous solidification effort that required four containers, by further optimizing the Nochar®-to-liquid ratio.

For more information:

<http://www.doe-md.gov/lstd/lstd.htm>

Tech ID 2201

*Mark Mintz, LLNL
925-422-8394
mintz1@llnl.gov*

*Don Krause, BWXT Services
937-865-4501
kraudr@doe-md.gov*

*Harold Shoemaker, DOE-NETL
304-285-4715
harold.shoemaker@netl.doe.gov*

▼ Idaho National Engineering and Environmental Laboratory (INEEL) Fuel Storage Canals and Associated Facilities D&D LSDDP

Objective and Scope: The INEEL Fuel Storage Canals and Associated Facilities LSDDP is led by an IC Team consisting of Parsons Engineering, BNFL, BBWI, TLG Engineering, Florida International University (FIU), and Idaho State University. This LSDDP will utilize funding, technologies, and expertise from the Offices of Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization, and from industry, universities, and the international community.

The project includes the following areas:

- Test Reactor Area 660 (TRA-660), housing two underwater research reactors, the Advanced Reactor Measurement Facility, and the Coupled Fast Reactivity Measurement Facility, with a 30,000-gallon interconnecting water canal that was sometimes used for fuel storage. These facilities were utilized for reactivity insertion experiments that were later scaled up for experiment design in larger reactors. The two reactors achieved criticality in 1960 and 1962, respectively. Neither has operated since February 1991. Contamination includes radioactive elements, lead, and chromium.
- TRA Filter Pit system, consisting of five structures containing large filters associated with test reactor operations. The facilities are contaminated with lead, radioisotopes, and deteriorating asbestos. The filters are located in restricted entry pits, and D&D work will have to be done

remotely and in confined spaces.

- Test Area North 620 (TAN-620) Initial Engine Test Control Room is a massive underground, shielded, heavily reinforced concrete structure that served as the control center for the engine tests in the Aircraft Nuclear Propulsion Program. These tests were conducted at INEEL in the late 1950s and 1960s. Contamination includes asbestos, mercury, lead, and potential radiation.

This LSDDP is a high priority for the DOE/Commercial Nuclear Utilities D&D Consortium, with demonstrated technologies having deployment opportunities in the nuclear utility market through the consortium. Resulting deployments throughout the DOE complex alone could generate a potential cost savings and mortgage reduction of \$20 million.

Seventeen innovative and improved technologies were demonstrated in the following areas: underwater inspection, characterization, and dismantlement; inspection, characterization, and dismantlement in restricted spaces; recycle of materials from D&D activities; removal of loose radiological contamination on walls, floors, piping, and equipment; removal of fixed radiological contamination on concrete; tank, vessel, and piping decontamination; lead plate radiological decontamination; and high-radiation exposure fields.

Status and Accomplishments: The 3D-Gamma Locator Device (GLD), the Isotopic Identification Device (IID), and the Ultra Lift device were all demonstrated and deployed during the period from July 10 – August 2, 2001. The final report for the LSDDP has been drafted and the demonstrations for the LSDDP are considered complete.

The INEEL LSDDP reviewed over 300 technologies, screened 141, and demonstrated 17. These 17 demonstrated technologies have been deployed a total of 69 times at facilities other than those where the technology was demonstrated, and ten have become baseline at INEEL. Sixteen needs have been removed from the Needs Management System and another 16 have been modified as a direct result of using these new technologies.

The ten-year projected cost savings at INEEL resulting from use of the

technologies demonstrated in this INEEL LSDDP exceeds \$39 million dollars.

Current Reporting Period Activities:

The preparation of the final report for this LSDDP is currently in progress.

For more information:

<http://id.inel.gov/lsddp/>

Tech ID 2202

*Andy Mikkola, DOE-ID
208-526-0725
mikkolaw@inel.gov*

*Dick Meserve, INEEL-BBWI
208-526-1834
rhm@inel.gov*

*Steve Bossart, DOE-NETL
304-285-4643
steven.bossart@netl.doe.gov*

▼LANL Tritium Facilities (Model B) LSDDP

Objective and Scope: The objective of the Los Alamos National Laboratory (LANL) Tritium Facilities (Model B) LSDDP is the reduction of cost, risk, and schedule for the deactivation, decontamination, and decommissioning of DOE's tritium facilities through the deployment of previously demonstrated, cost-effective, innovative technologies. The goal of this LSDDP is to identify and select at least 20 technologies that can be deployed at multiple sites. At LANL, leveragable funding of \$6.6 million is available over two years of the project. Leveragable funding from other sites is expected as well.

The primary deployment site for this LSDDP will be the LANL Tritium Systems Test Assembly (TSTA), an existing facility that is being stabilized by the current DOE program operator, the Office of Fusion Energy Science (OFES), in anticipation of transfer EM

*Los Alamos National
Laboratory (LANL)
Tritium Facilities*



for decontamination and decommissioning. The facility is operated for the OFES by LANL at Technical Area 21. The main experimental building is a 3700 square-foot high bay that contains process equipment and gloveboxes for fusion tritium R&D. The TSTA presently has a tritium inventory of 127 gm, which is the focus of the current stabilization activities. The TSTA tritium is in four forms:

- 1) gas in 50-liter tanks (about 20 tanks with approximately 40 gm tritium);
- 2) a solid absorbed on metal hydride beds (11 beds holding approximately 40 gm tritium and containing 50 kg of depleted uranium);
- 3) water on molecular sieve “moisture collectors” (currently about 40 containers holding a total of approximately 40 gm tritium); and
- 4) “holdup” in high surface area components (5-20 gm tritium).

This LANL Tritium LSDDP will facilitate expedited facility closure with the application of innovative technologies. Furthermore, the facility will become a model for implementation and deployment of innovative technologies at other DOE tritium facilities. The impact will be that the technologies deployed in this LSDDP will become the baseline technologies for future tritium facility closure operations.

Status, Accomplishments, and Current Reporting Period Activities: During October, the LANL Tritium Facilities LSDDP management team developed the Program Management Plan and the associated Communication Plan. Team representatives also participated in the DDFA LSDDP lessons-learned meeting in West Valley, NY. In November, planning was initiated for early deployment of the Tubing Crimper at TSTA. In December, the project website was established at <http://www.emtd.lanl.gov/LSDDPB/TSTA.html>. Team discussions with the Joint European Torus (JET) have indicated that they (JET) are interested in project participation. The initiation of the Tubing Crimper is anticipated in January.

For more information:

<http://www-emtd.lanl.gov/LSDDPB/TSTA.html>

Tech ID 3148

*Rich Nevarez, DOE-AL
505-845-5804
rnevarez@doeal.gov*

*John McFee, IT Corp.
303-793-5231
jmcfee@theitgroup.com*

*Harold Shoemaker, DOE-NETL
304-285-4715
harold.shoemaker@netl.doe.gov*



New or improved D&D technologies for fuel pools at INEEL and associated facilities

▼INEEL and Associated Facilities Fuel Pools and Material Dispositioning LSDDP

Objective and Scope: This LSDDP will deploy new or improved D&D technologies for fuel pools and associated facilities will demonstrate and deploy new or improved technologies for material dispositioning. This project will facilitate complex wide deployments of technologies proven successful in previous LSDDPs. These demonstrations and deployments will be targeted at Integrating Contractor (IC) Team member sites including Savannah River, Mound, Fernald, Hanford, Oak Ridge, and the INEEL.

This LSDDP will demonstrate and/or deploy innovative or improved technologies a minimum of 14 times over the life cycle of the project. Additional demonstrations and deployments will be conducted if the demonstrations/deployments are substantially cost-shared by technology vendors and DOE site operations. The

goal of this project is to conduct as many demonstrations and deployments as possible within the allotted funding while selecting technologies that have the most substantial positive impacts to deactivation and decommissioning projects within the DOE weapons complex. These impacts include cost reduction, schedule acceleration, reduced exposure to radiation, and improved worker safety.

Status, Accomplishments, and Current Reporting Period Activities:

The kick-off meeting was held November 7–8, 2001. Technology selection for deployments is expected to begin in January.

For more information:

Tech ID 3147

*Larry Whitmill
208–526–0375
wit@inel.gov*

*Jagdish Malhotra, DOE-NETL
304–285–4053
jagdish.malhotra@netl.doe.gov*

▼West Valley Demonstration Project (WVDP) Hot Cell LSDDP

Objective and Scope: The objective of the WVDP Hot Cell LSDDP is to demonstrate and deploy new and innovative technologies applicable to the decontamination and decommissioning of DOE surplus facilities, particularly hot cells. These technologies will have the potential to reduce costs, shorten schedules, and enhance safety across the DOE complex.

The WVDP, located in western New York, is a former commercial nuclear fuel processing facility that recovered uranium and plutonium from spent nuclear fuel. Two primary facilities have been selected for demonstration sites at the WVDP because of their ongoing and planned D&D activities. The Head End Cells, which contain significant amounts of highly radioactive debris and laboratory equipment, and the Extraction Cells, which contain solvent contaminated process vessels, tanks and piping. Demonstrations will also be targeted in the Fuel Storage Area. Non-host

site demonstration or deployment opportunities will also be sought at the Battelle Columbus West Jefferson site and at Hanford's 324 and 327 Hot Cell facilities. Both sites possess needs similar to the WVDP hot cells. The DDFA funding for the LSDDP is projected at \$4.3 million over three years.

Status, Accomplishments, and Current Reporting Period Activities:

The WVDP Hot Cell LSDDP received its initial funding in September 2001. The project kick-off meeting was conducted at the WVDP on October 10, 2001, followed by a site tour the next day. Initial project efforts have included finalizing the project team organizational structure and responsibilities, confirming the site technical needs to be addressed, and establishing the technology review/selection criteria. An integrated schedule showing potential demonstration opportunities by technology area based on the established D&D schedules for the target demonstration sites has been developed and team members have begun submitting information on innovative technologies for later evaluation by the team. A WVDP LSDDP web site has been developed and should be available for public use early in the second quarter of FY2002.

For more information:

<http://www.wv.doe.gov/lsddp/>

Tech ID 3149

*Jim Gramling
West Valley Nuclear Services
716–942–2119
gramlij@wvnsco.com*

*John Drake, DOE-WV
716–942–4993
john.l.drake@wv.doe.gov*

*David Szucs, DOE-NETL
412–386–4899
szucs@netl.doe.gov*

WVDP Hot Cell LSDDP



▼ Canyon Disposition Initiative

Objective and Scope: The Hanford Canyon Disposition Initiative (CDI) Project is a collaborative project that initially included participation across EM. Participating EM offices included the Offices of Waste Management, Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization. This partnership was driven by the understanding that decisions made on the disposition of the canyons would impact all of these programs. Due to the reorganization of EM in September 1999, CDI is being overseen by the Office of Project Completion.

The CDI Project is evaluating the feasibility of using the five chemical processing facilities (canyons) as assets for disposal of low-level wastes, instead of a mortgage liability. The 221-U Facility is being used as a pilot for this evaluation. The DOE Richland Operations Office (RL) Environmental Restoration Program signed an Agreement in Principle with regulators at the beginning of FY1997, to conduct the evaluation for the disposition alternatives for the canyon facilities. In 1996, a Canyon Task Team of personnel from RL, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology (known as the Tri-Parties) conducted a series of workshops to identify an approach for the long-term disposition of the five main processing facilities in the 200 Area (B, T, and U facilities, the Plutonium Uranium Extraction Facility, and the Reduction Oxidation Plant) at the Hanford Site. The assessment made by the Canyon Task Team centered on the possibilities of removing the processing facilities, leaving all or part of the facilities in place and identifying alternative beneficial uses for the facilities. The team concluded that the technical approach for dispositioning any of the facilities could be bounded by the following seven alternatives:

Alternative 0:

No Action

Alternative 1:

Full Removal and Disposal

Alternative 2:

Decontaminate and Leave in Place

Alternative 3:

Entombment with Internal Waste Disposal

Alternative 4:

Entombment with Internal/External Waste Disposal

Alternative 5:

Close in-Place — Standing Structure

Alternative 6:

Close in-Place — Collapsed Structure

The Record of Decision for the 221-U Facility will generate regulatory and technical precedence for future disposition of the other four remaining processing facilities at Hanford and other such facilities across the DOE complex.

Status, Accomplishments, and Current Reporting Period Activities: Approximately \$200,000 in funding from FY2000 has carried over into FY2001 for a Phase III feasibility study and proposed plan for a record of decision. CDI was also awarded \$700,000 additional funding through Pollution Prevention. All milestones have been completed. The "Feasibility Study" and "Proposed Plan" document deliverables have been submitted to DOE and the regulatory organizations in support of a final Record of Decision (ROD) for the Hanford U-Plant facility.

For more information:

<http://bhi-erc.com/canyon/canyon.htm>

Tech ID 2178

Kim Koegler, BHI

509-372-9294

Kjkoele@bhi-erc.com

John Sands, DOE-Richland

509-372-2282

john_p_sands@rl.gov

Ron Staubly, DOE-NETL

304-285-4991

ron.staubly@netl.doe.gov

▼ RFETS D&D Initiative and Associated ASTD Projects

Objective and Scope: RFETS is on an aggressive, accelerated schedule to achieve cleanup and closure by the end of 2006. The baseline plan for the Rocky Flats Closure Project involves dispositioning over 900 contaminated gloveboxes, more than 450 production process tanks,

thousands of feet of ventilation system piping, and miles of production process piping. In order to accomplish this challenging goal, RFETS has incorporated into their baseline plan application of new and innovative technologies for characterization, decontamination, size reduction, and waste handling and packaging.

A significant cost in the D&D of buildings at RFETS is the size reduction and packaging of plutonium-contaminated gloveboxes, tanks, and other equipment. DDFA is supporting the disposition of these systems through the Rocky Flats D&D Initiative (RFI), as well as ASTD projects including:

- Enhanced Cutting Tools
- Systems to Centralize Size Reduction
- Remote In Situ Size Reduction of Plutonium-Contaminated Gloveboxes and Equipment (Tech ID 2987)
- Decontamination of Gloveboxes, Tanks, and Equipment For Shipment without Size Reduction (Tech ID 2986)
- Demolition of Contaminated Buildings
- Characterization Disposition of Contaminated Buried Equipment
- Beryllium Monitoring and Characterization
- Upgrade Radiation Instruments

All of these projects seek to identify and deploy proven, commercially available technologies and innovative systems that require only minimal modifications for the safe and cost-effective disposition of contaminated processing equipment and systems. RFI serves to augment the ASTDs and to support problem-specific deployments not currently funded by an ASTD project, such as the characterization and eventual removal of concrete-embedded equipment in Building 776.

Status, Accomplishments, and Current Reporting Period Activities:

Enhanced Cutting Tools: RFETS has initiated work to procure and fabricate improved manual/remote containment systems and cutting equipment for size reduction of plutonium-contaminated gloveboxes, ducts, and equipment. This element includes improved containment systems such as Inner Tent Chambers (ITC). The ITC Phase 2 allows remote cutting by operators standing outside

a containment structure. In FY2002, this element also includes enhanced duct cutting tools and systems to compact ducting for packaging.

Status:

Cold testing of the Phase 2 ITC with manipulator arms in Building 771 is underway and hot startup of the system is expected to be completed by the end of January 2002.

Building 776 also installed a Phase 2 ITC, which is a modification of the 771 system using a boom that moves in three directions to lift and place pieces in the Standard Waste Box. This ITC is installed, tested, and ready for operations when necessary to size-reduce transuranic items.

Improved duct cutting tools have been evaluated and tool concepts from three vendors selected. Each vendor will construct prototype tools for testing. Schedules for delivery of the prototype tools are being negotiated.

Systems to Centralize Size Reduction: supports the work to complete procurement and authorization of a standardized, inter-building TRU waste transportation system.

Status:

The Engineering and Nuclear Licensing group has completed a proposed change to the Site Transportation Safety Analysis Report. This change will authorize loading at the dock and transporting large pieces of equipment between buildings independent of the container for items containing less than 700 grams of plutonium. The submittal is pending approval by the DOE Rocky Flats Field Office.

Remote In Situ Size Reduction of Plutonium Gloveboxes: An In Situ Size Reduction System supports design, procurement, and fabrication of remotely operated systems capable to size-reduce and package oversized gloveboxes and other contaminated equipment in Building 771 that cannot be transferred to a centralized size reduction facility. Thick items in Building 776 will be size-reduced in FY2002.

Status:

The system for remote in situ size reduction of plutonium-contaminated gloveboxes and equipment has been set up in a training area at Rocky Flats. Shakedown testing has commenced and materials developed for operator training.

Demonstration of a metal/oxygen exothermal torch for cutting thick items is complete and the technology is available for use pending approval of new authorization basis for B776 and B707.

A new system for cutting thick items using a cable wire saw is being investigated for deployment in Building 776. Cable wire saw cutting has advantages over thermal cutting techniques because it does not challenge the nuclear safety authorization basis.

Decontamination of Gloveboxes and Equipment without Size Reduction: This task supports Site projects for the deployment of improved decontamination, instrumentation, and fixative technologies to allow shipping and disposal of plutonium-contaminated gloveboxes and equipment as low-level waste without the need for size reduction.

Several efforts are being supported by this project to improve the Site's ability to ship equipment as surface-contaminated objects (SCO).

Status:

Deployment of structural foam by Building 776 project that meets Rocky Flats, DOT, and land disposal requirements is complete. The foam was used successfully to brace heavy items in waste containers. This technology is now being deployed by other projects.

The contract to modify and procure a raschig ring vacuum extraction system for use in Building 371 was not issued. Project personnel have determined that standard, commercially available equipment can be readily adapted to suit their needs. Support for this effort has been withdrawn.

A prototype survey instrument capable of measuring low levels of plutonium under paint on walls was tested. The final report is due in January, but initial impressions are that the assay time is too long and the uncertainty of the results is too great to be very useful. The vendor will propose modifications to the instrument to correct these deficiencies.

Demonstration of proprietary coating removers for the removal of paint, epoxy, and coatings on buildings and equipment has been completed. The test had mixed results. The coating remover chemicals worked well on

nonporous surfaces, but results were marginal on porous surfaces. This technology may still be deployed when B771 is ready to initiate decontamination of interior surfaces.

Building 371 has a current project to remove the raschig rings from eight tanks followed by decontamination of the tanks to SCO by steam injection of cerium nitrate. Removal of the raschig rings from the tanks has been completed but the use of cerium nitrate was determined to be unnecessary as the tanks met the SCO disposal criteria without further action. The cerium nitrate solution was tried on two gloveboxes in Building 371 after conventional techniques failed to reduce contamination to SCO levels. The test was successful; after a relatively brief application period the gloveboxes met SCO contamination levels. Over the next quarter, other facilities will try the cerium solution on gloveboxes.

771 Project completed evaluating vendor proposals for sludge removal and decontamination of tanks in the low-level waste processing building 774. The evaluation determined that using the proposed technologies is not feasible and this project has been canceled. Sludge removal and decontamination of tanks in the building will be performed using conventional techniques.

The two additional efforts proposed for FY2002 are still under evaluation. The first is the deployment of technologies to decontaminate large volume containment systems such as the advance size reduction system, the stacker-retriever, and the x-y retriever. The second is the deployment of technologies for the decontamination of ducts and chainveyor lines.

Demolition of Contaminated Buildings: This effort will define the criteria, conceptual approach, and initial engineering for the demolition of a contaminated structure. Current plans are to complete the engineering design, procurement, and construction of a containment system for Building 776 in FY2002. Demolition of the buildings is expected to take place in FY2003–2004. In support of this effort will be the deployment of equipment for remote strip out of buildings.

Status:

The conceptual approaches and initial cost estimates for contamination control during

final strip out and demolition of Building 776/777 have been developed. A decision to select the preferred method is pending.

Characterization and Disposition of Contaminated Buried Equipment: This task was intended to define and characterize areas that contain buried equipment below the floor in Building 776. Removal and packaging of the buried equipment is expected to take place in FY2003–2004.

Status:

Work on this element is being discontinued. No candidates have been identified that will characterize buried equipment adequately without physical intrusion into the area of concern. This activity is a low-priority need for FY2002.

Beryllium Monitoring and Characterization: This project supports the development and deployment of beryllium instrumentation to provide real-time air monitoring and to provide in-building reading of swipes and filters.

Status:

A contract has been awarded to Amzil, Inc. for a beryllium air monitor. Measurements of blind standards prepared at Rocky Flats indicate that the technology will operate down to the Site standard of 0.1 (g/m³). Delivery of the first system for testing is scheduled for the first week of March.

Science and Engineering Associates (SEA), Inc. will be performing field-testing of their Beryllium Analyzer system in January 2002. The specific objectives of the field tests are to test the overall Beryllium Analyzer system in a real-world environment, verify the operation of the instrument as a means to analyze swipe samples, and evaluate the operation of the analyzer as a continuous air monitor. Actual samples from Building 444 are being taken to SEA to perform the tests. If successful, procurement of a SEA system would occur in FY2002.

Upgrade Radiological Instrumentation: This project supports the deployment of a suite of state-of-the-art instrumentation and data collection systems required for compliance with radiation control, release limits, and control/tracking of waste.

Status:

Work on systems for D&D waste packaging, tracking, and electronic generation of Waste Isolation Pilot Plant (WIPP) and Nevada Test Site (NTS) certification

documentation is complete. The new electronic system has been implemented and is functioning as anticipated, saving considerable time in the generation of waste certification documentation.

A gamma measurement system and a technical basis will be developed to allow relative measurement of internal surface contamination from the exterior of ducts and tanks. These measurements should greatly reduce the number of internal measurements required to certify an object as SCO. The contract was awarded but the vendor cannot initiate work until March 2002. A system is expected to be available in the third quarter of FY2002.

For more information:

Tech ID 2918

*Gary Huffman, DOE-OST
303-966-7490
gary.huffman@rfets.gov*

*Cliff Carpenter, DOE-NETL
304-285-4041
cliff.carpenter@netl.doe.gov*

▼ Mound Facilities Long-Term Stewardship (LTS) Initiative

Objective and Scope: The Mound LTS Initiative is designed to identify, select, demonstrate, and deploy technologies and systems that will provide DOE, regulators, stakeholders, and the public with the assurance that the public and the environment are protected from harm after cleanup of the Mound site is completed in FY2006. This initiative is intended to serve as the prototype for LTS of all DOE buildings and equipment. It will serve as a test bed for a suite of real-time integrated surveillance and monitoring systems, which will function autonomously to transmit data to remote locations.

Status, Accomplishments, and Current Reporting Period Activities: In early September, the Mound Facilities LTS Initiative Kick-Off Meeting was conducted at the Mound Plant Site, Miamisburg, Ohio. The project Technology Team was identified and progress was made in developing a path forward. It was decided that LTS technologies would be selected to support/enforce institutional and administrative controls.

Follow-up events such as biweekly conference calls, all-hands meetings every 3 to 4 months, and a workshop for technology vendors either the first week of December or sometime in January were tentatively scheduled.

For more information:

Tech ID 3128

*Sue Smiley, DOE–Ohio
937–865–3984
sue.smiley@ohio.doe.gov*

*Harold Shoemaker, DOE–NETL
304–285–4715
harold.shoemaker@netl.doe.gov*

▼ **Highly Selective Nuclide Removal System Accelerated Site Technology Deployment (ASTD)**

Objective and Scope: In 1992, the last of the five DOE production reactors at Savannah River Site (SRS) was placed into shutdown mode, with no intention to restart. With this action, the site entered an extensive deactivation and long-term surveillance and maintenance life-cycle phase of these facilities. The integrity of the aging facilities has become a concern in recent years. Large volumes of contaminated water exist at some of these facilities at SRS (for example, fuel storage and disassembly basins). Treatment of this water requires removal of the water from the basin and shipment to the F and H Area Effluent Treatment Facility (ETF). A cost-effective and safe technology is needed to process the basin waters on location and selectively remove radioactive materials without transporting the water to ETF. The technology must reduce targeted nuclides to near DOE release limits and condition the water for direct release. Efforts to address these concerns have been initiated under the current funding for reactor monitoring and are being incorporated into the overall facility deactivation, decontamination, and decommissioning planning strategy. With the uncertainty of the basin integrity over time, a technology that can remove radioactive contamination from the basin water while minimizing secondary waste generation is essential to the success of the deactivation

of the DOE reactor basins. The SRS ASTD is deploying an innovative, highly effective water treatment system to remove selected radionuclides (both strontium and cesium) from millions of gallons of water. Overall, D&D life-cycle costs are expected to significantly decrease via deployment of the technology.

Status, Accomplishments, and Current Reporting Period Activities:

The SRS R-Area Reactor Basin water is being treated with a 3M/Empore® Cartridges membrane (for Cs-137) and the Graver/Selion System (for Sr-90). The first 3M/Empore® Cartridges Ion-Exchange technology demonstration was initiated at R-Area Basin on June 21, 2000 and completed on August 16, 2000. As of July 25, 2001, over six million gallons of R-Area Basin water have been treated with the Cs-137 3M/3M/Empore® removal system. The demonstration showed 97% removal of Cs-137, with Cs-137 activity in the basin reduced to within the target cleanup level. 3M/Empore® Cartridges have proven to be very successful throughout the DOE Complex and treatment with the 3M/Empore® Cs-137 removal system at SRS R-Area Reactor Basin will continue in FY2002 in parallel with the Graver/Selion Sr-90 removal system.

For more information:

Tech ID 2937

*George Mishra, DOE–SR
803–725–7239
george.mishra@srs.gov*

*John Pickett
Westinghouse Savannah River Company
803–725–3838
john.pickett@srs.gov*

*Jagdish Malhotra, DOE–NETL
304–285–4053
jagdish.malhotra@netl.doe.gov*

▼ **Integrated Excavation Control System (IECS) ASTD**

Objective and Scope: This ASTD involves a partnership between Fernald Environmental Management Project (FEMP) and INEEL to procure and deploy an excavator arm with real-time sensors for precision

excavation of above-Waste Acceptance Criteria (WAC) materials and real-time pre-certification surveys in complex terrain. The IECS will address real needs at Fernald and other sites that require the complex excavation of radionuclide-contaminated soils during the below-grade D&D of large structures.

Status, Accomplishments, and Current Reporting Period Activities:

After the completion of acceptance testing, it was determined that minor hardware and software modifications were needed. Minor modifications and enhancements of the Excavation Monitoring System (EMS) identified during acceptance testing were completed in December 2001. Project personnel are confident that EMS will be fully operational in the spring of 2002 for the start of the full-scale excavation in Area 3A.

For more information:

Tech ID 3180

*Kathleen Nickel, FEMP
513-648-3166
kathi.nickel@fernald.gov*

*Larry Stebbins, Fluor Fernald
513-648-4785
larry.stebbins@fernald.gov*

*Harold Shoemaker, DOE-NETL
304-285-4715
harold.shoemaker@netl.doe.gov*

▼ Remote Size Reduction for Large Hot Cell Deactivation ASTD

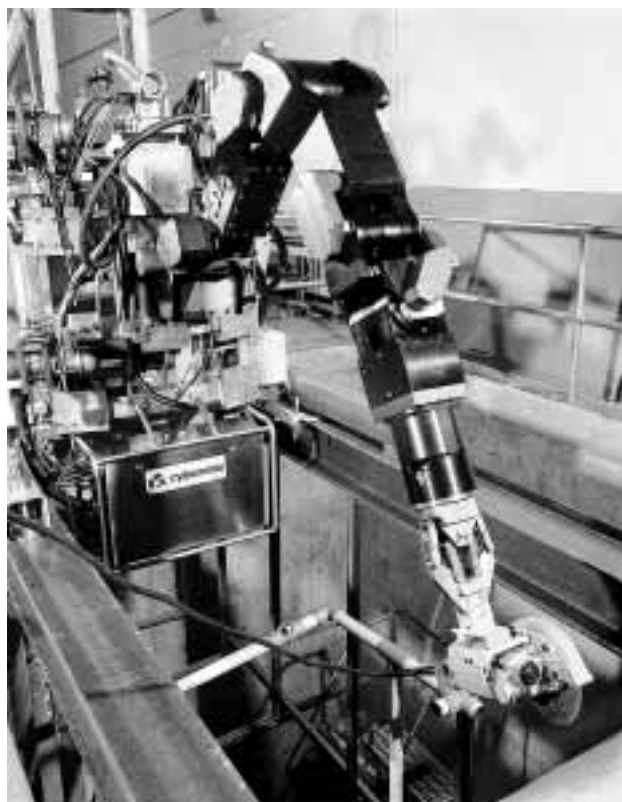
Objective and Scope: The 324 Building, located at the Hanford Site near Richland, Washington, is being deactivated to meet state and federal cleanup commitments. The 324 Building has several highly radioactive tanks, tank vaults, piping, and large hot cells containing complex chemical processing equipment. To meet the cleanup commitments, there is a need to deploy more rapid and remote size-reduction, debris collection and removal, characterization, and decontamination methods. Readily deployable deactivation methods that reduce worker exposure, secondary waste generation, costs, and risks are also needed. Deployment of a remote/robot work platform in the 324 Pipe Trench

with full reach capabilities will significantly accelerate work tasks, eliminate the need for multiple, specialized tool design and procurement, and reduce the overall program risks.

The Hanford Site ASTD project will fund the deployment of a robot work platform to support deactivation of the 324 Building Pipe Trench. Through this project, Hanford will procure and deploy a remote/robot work platform that is positioned with an overhead crane to perform a variety of deactivation activities. Following the Pipe Trench cleanup, the work platform will be deployable for other 324 and Hanford site cleanup missions.

Status and Accomplishments: The original contract with Cybernetix was modified to include fabrication of a special support structure to allow the robotic work platform to be placed in the 324 Building's Airlock Pipe Trench. All contracted equipment was received in March 2001. The robotic system was then set up in Hanford's 306-E Building to perform Site Acceptance Testing, receive initial training from the vendor, perform detailed training with facility operations and maintenance staff, and perform a broad suite of deactivation tasks in the mock-up of the Pipe Trench. In late September 2001 the robotic system was transferred from the 306-E Building to begin its deployment in the 324 Building's Airlock Pipe Trench.

Current Reporting Period Activities: During this quarter, Cybernetix completed the first deployment in the Pipe Trench. The system supported cutting, removal and han-



*Photo (NEW) of Cybernetix
Robotic Work Platform in
the 306-E Building Pipe
Trench Mockup:*

ding of piping, and removal of drip pans and other highly contaminated debris. The waste from the Pipe Trench's Phase 1 cleanout effort will be transported to Hanford's 200 Area for storage in January 2002. The Cybernetix system will now undergo decontamination, maintenance and preparation for its next mission to support the removal of spent nuclear fuel from 324 Building B-Cell. Due to its robust design, the robotic system is targeted for use on a variety of deactivation tasks in the 324 Building over the next four to five years.

For more information:

Roger Pressentin
509-376-1291
roger_a_pressentin@rl.gov

Kurt Lenkersdorfer, Fluor Hanford
509-373-5182
kurt_a_lenkersdorfer@rl.gov

Greg Berlin, Fluor Hanford
509-376 2389
gregory_t_berlin@rl.gov

Ron Staubly, DOE-NETL
304-285-4991
ron.staubly@netl.doe.gov

▼LANL Decontamination and Volume Reduction System (DVRs) ASTD

Objective and Scope: LANL currently has more than 2,400 cubic meters of oversized metallic TRU waste in storage. This waste is non-certifiable for shipment to the Waste Isolation Pilot Plant (WIPP) in its present packaging configuration. In addition, another 3,000 cubic meters of similar waste from on-site D&D activities and site upgrades are at various locations at LANL. To meet cleanup commitments, there is a need to deploy a system for decontaminating and volume-reducing this waste that is less costly, less labor intensive, and quicker than the baseline method of processing the waste entirely by hand. The disposal of oversized metallic TRU waste is a problem at many DOE sites.

The DVRs process will reduce the volume of oversized metallic TRU waste using an integrated system of technology and equip-

ment for assaying, confinement, decontamination, and volume reduction. The project includes a 13,200-square-foot outer building along with a 2,500-square-foot contamination-control structure nested inside. Both structures have active ventilation and contamination control; a multi-station passive-active, neutron non-destructive analysis system; several fixed and portable processes for decontamination of metal objects; and a large dedicated system to shear and crush large metallic objects for placement in 55-gallon drums.

Status and Accomplishments:

Both the outer building and contamination control structure are complete.

Current Reporting Period Activities:

The facility has been engaged in process performance testing/optimization, expanding procedures for flexibility, training effectiveness, and system reliability centered maintenance. These operations are being done to prepare the facility for expanded operations.

For more information:

Tech ID 2242

<http://www.emtd.lanl.gov/LSDDP/Ddtech.html>

Jim Orban, DOE-Albuquerque
505-845-4421
jorban@doeal.gov

Steve Bossart, DOE-NETL
304-285-4643
steven.bossart@netl.doe.gov

▼Oversize TRU Waste Laser Cutting System ASTD

Objective and Scope: DOE-Nevada has a need to size-reduce and characterize 58 oversized TRU-contaminated metal boxes with a total volume of 270 cubic meters prior to shipping them to the WIPP. The contents of these boxes are 32 contaminated gloveboxes, a metal cutting lathe, lengths of metal piping, lengths of angle iron, and various scrap metals. The Hanford material requiring size reduction includes a minimum of 150 gloveboxes, as well as ductwork and piping. At Rocky Flats Environmental Technology Site (RFETS), the laser cutting system will also be applied to 150 contaminated gloveboxes.

Status, Accomplishments, and

Current Reporting Period Activities:

Laserdyne Prima, which is now conducting the laser cutting system integration testing, recently purchased GSI-Lumonics. Laserdyne expects to receive the final safety equipment by mid-September. The final vendor acceptance test for the total laser cutting system integration is scheduling for late September. At this time, Fluor Hanford has not been able to identify a location or funding for the pre-operational testing of the laser system at Hanford following the Laserdyne acceptance test. Therefore, the project team has decided to perform pre-operational testing at the LANL, probably at Q-Site. Department of Defense (DoD) laser cutting tests were performed recently at the Q-Site, which makes the Q-Site an appropriate site for the pre-operational testing. The current plan is to ship the laser system from Laserdyne to LANL in October, after the vendor acceptance test is performed.

For more information:

Chuck Morgan, DOE-NV

702-295-0938

morganc@nv.doe.gov

Harold Shoemaker, DOE-NETL

304-285-4751

harold.shoemaker@netl.doe.gov

▼Reducing, Reusing, and Recycling Concrete and Segmenting Plate Steel and Tanks Utilizing a Universal Demolition Processor (UDP) ASTD

Objective and Scope: As D&D work at Fernald progresses from above-grade facilities to at-grade and below-grade facilities, there will be a need for new technologies to process concrete. Fernald can realize significant cost savings by reprocessing and reusing a portion of the site's concrete. There is a need for aggregate to build and strengthen the site's transportation infrastructure in and around the On-Site Disposal Facility (OSDF). Project personnel in the Soils and Water Division have an estimated need for up to 15,000 cubic yards of aggregate per year for the next 6 years. By not recycling the site's concrete, tons of aggregate will have to be

imported from off-site locations and subsequently disposed in the OSDF. Reprocessing a portion of the concrete saves the costs associated with the purchase of virgin aggregate and its subsequent disposal cost. The site can also realize increases in safety, efficiency, and schedule by utilizing the plate shear capability of the UDP. Fernald has numerous large, heavy steel tanks including two water towers and numerous tanks made of stainless steel.

Through this ASTD, innovative technologies will be deployed to accelerate demolition/recycling of construction materials for road construction and for segmenting large, hard-to-cut plate steel and tanks. The overall decommissioning life cycle costs are expected to significantly decrease via the deployment of these technologies.

Status, Accomplishments, and Current Reporting Period Activities:

The UDP has completed processing 16 concrete pads or structures containing approximately 2300 cubic yards of concrete. Numerous large roll-off boxes have been filled with the rebar that fell out of the concrete during crushing activities. The rebar is taken to the OSDF for disposal.

The concrete pads or structures completed are 10B, 10D, 10E, 12B, 12C, 12D, 12B-D adjacent area, 20B, 20C, 20H, East & West Reactivator Pad, and a portion of 19D. Field work continued through October. Other locations targeted for concrete processing include 10A-Precipitator Pad (north and south), 10C Pad, Clearwell, and 12A Pad. These additional four structures contain over 2,200 cubic yards of concrete, which will bring the project total to over 4000 cubic yards.

Approximately 20 percent of the processed aggregate has been reused as roadbase within the Fernald site.

For more information:

Tech ID 2981

Kathleen Nickel, FEMP

513-648-3166

kathi.nickel@fernald.gov

Mark Peters, Fluor Fernald

513-648-6325

mark.peters@fernald.gov

Harold Shoemaker, DOE-NETL
304-285-4715
harold.shoemaker@netl.doe.gov

▼ Improved Measurement and Monitoring Systems (IMMS) ASTD

Objective and Scope: The FEMP is a 1,050-acre DOE Closure Site currently undergoing decommissioning and environmental restoration. As environmental cleanup work at the FEMP accelerates towards closure and LTS, there is an increasing need for new, innovative technologies to perform real-time physiological monitoring, land surveying, and wireless radon monitoring. In the process of D&D of DOE facilities, individual laborers sometimes need to work in or near radiological and hazardous locations, as well as in situations that lead to extreme physical conditions. These types of extreme conditions will likely occur in the upcoming FEMP Silos Project and in other restoration projects across the site. Technologies are needed that reduce workers' risk during engineering, construction, and environmental restoration operations. To minimize these risks, three new technologies have been identified for deployment at FEMP. Collectively, these technologies will provide for the monitoring of worker vital signs, improved land surveying, and the remote transmission of radon monitoring data.

Status, Accomplishments, and Current Reporting Period Activities:

1. **Prismless Total Surveying Station:**
The FEMP continues to deploy Leica's prismless robotic total station on a full-time basis. The Prismless Total Survey System is in the Surveyor's toolbox and has become the preferred method in many situations. It is used weekly (if not daily) to support numerous projects across the site. A fact sheet has been written and is being circulated for comments. A draft letter report has also been written and will be issued when complete. The instrument continues to demonstrate high productivity regarding data collection and increased worker safety. The site survey technician is working with the instrument and generating a data sheet that will help

in determining total cost savings.

2. **Wireless Physiological Monitoring System:** Shipment of the Wireless Physiological Monitoring System has been postponed until March 2002. Worker training will be scheduled in March. Activities currently are at a minimum on this part of the project until the equipment arrives.
3. **Wireless Integrated Radon Monitoring System:** Deployment of the Wireless Integrated Radon Monitoring System occurred on November 14, 2001, when the system successfully completed the five-day field test.

For more information:

Kathleen Nickel, FEMP
513-648-3166
kathi.nickel@fernald.gov

Mark Peters, Fluor Fernald
513-648-6325
mark.peters@fernald.gov

Harold Shoemaker, DOE-NETL
304-285-4715
harold.shoemaker@netl.doe.gov

▼ Intrusive and Non-Intrusive Characterization through Concrete Walls and Floors ASTD

Objective and Scope: In mid-FY2000, the MEMP was awarded an ASTD project to ascertain the nature and extent of contamination in an area under SW Building known as the "Old Cave." The Old Cave is actually the entombed remains of a 1950's hot cell, which must be removed before the City of Miamisburg, Ohio, will accept ownership of the Mound Site. In SW Building, the Old Cave is located under an area designated SW-19. Because of lack of knowledge of what is in the Old Cave area, ultra-conservative estimates of the amounts of actinium-227 and radium-226 have been made that required the Old Cave to be classified as a Category 2 Nuclear Facility. It is considered highly unlikely that much radioactive material resides in the Old Cave. The approach is to characterize SW-19, the surroundings, and the entombment. In Phase I—Non-Invasive Investigations the entombment

will be characterized using ground-penetrating radar and time-domain electromagnetic gamma spectrometry, drain exploration, and radon monitoring. In Phase II—Invasive Investigations, these investigations will be performed with respect to the entombment via diamond core drilling and/or geoprobe with a real-time position location determination device. Once radioactivity levels are determined and a final design decision to the Baseline Plan is made, several enhancements that shorten the schedule and reduce costs may result. A baseline recovery of only one week would recoup the entire ASTD investment. If the baseline acceleration is greater than the one week, the return on investment will increase proportionally as additional weeks/months are saved from the baseline. Based on the Value Engineering Study, it is conservatively estimated that four months can easily be recovered when compared to the present technical approach.

Status, Accomplishments, and Current Reporting Period Activities:

During October, the Old Cave team initiated the SW/R Buildings Hazards Investigation with a walkover gross gamma survey around the SW and R Buildings. The detector used for the walkover was a calibrated Bicron G-5 NaI (FIDLER) probe (five-inch diameter by 127 mm thick). The scanning technique consisted of walking straight lines back and forth with one-foot centers between passes. The scan rate was approximately 0.5 feet/second, with the probe within one inch of the ground surface. With the exception of one localized spot across the street, south of the R Building, the only area identified with elevated levels was south of the SW Building, in the vicinity of the Old Cave entombment. Follow-up gamma spectroscopy measurements were made at each elevated location identified. The purpose of this survey is to assist in selecting locations for the Phase II intrusive measurements. The team also continues to prepare the HVAC and sprinkler system design in the Old Cave area for the subsequent removal of the Old Cave entombment. A remote camera and lighting system for operating a BROKK excavator for the entombment removal is being developed. The Team is working closely with Hanford and INEEL who have

BROKK units. Both Hanford and INEEL have experience that will be very helpful to Mound in handling the probable heavy plate material (possibly one inch thick) and other metal support/fasteners. A plasma torch system has been included into the project design to ensure that a means to downsize the heavy metal items is available. This project is not only associated with Mound but the other Ohio sites as well. Geoprobe® subsurface investigations are expected to commence soon at the Ashtabula Environmental Management Project (AEMP) to perform subslab characterization. Borehole sampling (88 boreholes) has occurred throughout September and October under the direction of the Subsurface Contaminants Focus Area's (SCFA) Innovative Treatment Remediation Demonstration (ITRD) group. The results of the direct scanning (Geoprobe®) and/or X-ray fluorescence analysis are used to direct further analysis and collect confirmatory samples for gamma spectroscopy, Tc-99, Toxicity Characteristics Leaching Procedure metals and volatile organics analyses. The Geoprobe® borehole work was completed in December. The lab work is anticipated to be completed in January. The ITRD group is highly involved in the evaluation of the results. This characterization work is expected to bring a better method of remediation to light at AEMP. This is a case of cooperation between the Ohio DOE sites, DDFA, and SCFA, where Mound has been able to leverage ASTD funding for the AEMP.

For more information:

Tech ID 2982

Doug Maynor, MEMP

937-865-3986

doug.maynor@ohio.doe.gov

Don Krause, BWXT Services

937-865-4501

kraudr@doe-md.gov

Harold Shoemaker, DOE-NETL

304-285-4715

harold.shoemaker@netl.doe.gov

▼MARSSIM Innovative Characterization at NTS

Objective and Scope: The NTS deployment of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) methodology and in situ characterization technologies include radiological characterization of various structures and waste packages associated with deactivation and decommissioning. These non-standard applications present opportunities for significant cost savings when compared to the NTS baseline methodologies. This ASTD project consists of two components. The first component is the deployment of the In Situ Object Counting System (ISOCS) (Tech ID 2098) manufactured by Canberra Industries, Inc. This innovative technology will be used to assist in the radiological characterization of various structures and waste packages associated with the NTS D&D program. The second component is to use the MARSSIM methodology to verify that the exterior of the Area 25 Reactor Maintenance Assembly and Disassembly (R-MAD) facility can be released for disposal prior to demolition of the R-MAD structure. The purpose of this deployment is to compare the costs of conducting the MARSSIM release survey to the baseline methodology of a radiological control technician performing clearance surveys for each waste package.

Status, Accomplishments, and Current Reporting Period Activities:

The second deployment of ISOCS by Brookhaven National Laboratory (BNL)-staff, which was canceled in the wake of the terrorist activities of September 11, 2001, was completed during the first quarter of FY2002. These activities included waste calibration of 55-gallon drums and B-25 boxes, and in situ measurements of contaminated ductwork. Review of the ISOCS geometric models and cast analysis of MARSSIM and ISOCS have been completed. The final report is currently being prepared.

For more information:

*Jeff Smith
Bechtel Nevada Environmental
Restoration
702-295-7775
Smithjl@nv.doe.gov*

*David Schwartz, DOE-NETL
412-386-6714
david.schwartz@netl.doe.gov*

▼Demonstration and Deployment of Remotely Operated Size Reduction System (ROSRS) ASTD

Objective and Scope: The Savannah River Site (SRS) has identified over 600,000 cubic feet of radiologically contaminated large equipment (CLE) requiring disposition. This represents a much larger quantity than anticipated. DOE Order 435.1 will elevate regulatory attention and surveillance impacts for this stored material. The cost will increase significantly for deferring permanent disposition. Disposal of this material in its current condition would consume the SRS waste disposal capacity, be cost prohibitive, and waste DOE assets.

SRS originally proposed to procure a suite of four systems to augment existing infrastructure and facilitate size reduction and decontamination of CLE. The proposal was submitted and approved as an ASTD, titled Disposition of Contaminated Large Equipment. The original funding amount was \$500,000.

The ROSRS was originally intended for deployment at RFETS, also as an ASTD. An alternate system was subsequently deployed. The ROSRS was combined with the SRS CLE project to form a new SRS ASTD, titled Demonstration and Deployment of ROSRS. The Scope of Work (SOW) was subsequently completely changed and rewritten. The scope now includes the installation, shakedown, and demonstration of the ROSRS at SRS in FY2002.

The approach proposed above capitalizes on the remotely operated technologies and equipment to minimize health and environmental risks, as well as to accelerate cleanup and reduce costs while meeting project objectives. The ROSRS will be used in conjunction with the SRS Decontamination Facility to provide capabilities for disposition of large equipment and to support ongoing routine decontamination work.

Status, Accomplishments, and Current Reporting Period Activities:

The Oceaneering Contract was officially

transferred from Kaiser-Hill at RFETS to Westinghouse Savannah River Company on October 12, 2001. The contract assignment was executed following the DOE determination that the project would be a General Plant Project. SRS has determined that several modifications in the Decon Facility will be required to support installation of ROSRS. The loading capacity of the floor in the Decon Facility may not be able to accommodate the structural requirements of system. Depending on the outcome of an additional structural evaluation, this could significantly impact both the cost and schedule for the project. The conceptual design for modifications other than those related to the structural evaluation are completed and the structural design calculations to determine the adequacy of the structure are in progress. In order to install ROSRS at SRS, the following modifications to the system are required: 1) Change the system to accommodate B25 boxes vs. TRU waste containers, and 2) Modify the layout of the ventilation system. All change modifications appear reasonable and should not delay the deployment of the ROSRS.

For more information:

Tech ID 3084

Dave Yannitell

*Westinghouse Savannah River Co.
803-725-4605*

david.yannitell@srs.gov

*Cliff Carpenter, DOE-NETL
304-285-4041*

cliff.carpenter@netl.doe.gov

▼D&D Consortium

Objective and Scope: In December 1997, DOE signed a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI) and several nuclear utilities to jointly develop and deploy new D&D technologies. DOE's objective is to expand the reach of benefits of the leading-edge technologies being deployed within the DOE nuclear complex. The MOU Consortium established a charter in early 1998 and identified challenging technological areas common to both DOE and the commercial industry.

Both DOE and commercial sites will be used for these demonstrations and deployments.

DOE and EPRI are collaborating to conduct quarterly workshops at various nuclear plants around the country, each focusing on a particular decommissioning area. DOE and the utilities present the most recent, innovative technologies to improve productivity and worker safety while reducing cost. The workshops will solicit feedback from hands-on plant managers and field workers. Topics covered to date address low-level waste disposal, concrete decontamination, embedded pipe decontamination, and site characterization.

Status and Accomplishments: The first technology demonstration resulting from the DOE/EPRI/Utility Consortium was completed at the Rancho Seco Nuclear Power Plant.

The first technology demonstration involved the concrete shaving technology developed by Marcrist Industries, Ltd. Two separate pieces of equipment were demonstrated. Both used a diamond-impregnated shaving drum as the cutting tool for removal of the concrete surface. Dust generated was collected by a vacuum system and deposited in a waste drum. The first piece of equipment was a self-propelled, electric powered floor shaver. The second piece was a hydraulically powered wall-shaving unit.

Current Reporting Period Activities: The DDFA has coordinated with the Rancho Seco staff and Florida International University (FIU) to start another round of demonstrations of innovative technologies. The DDFA assisted FIU and Rancho Seco Site personnel in selecting 2 technologies for demonstration, as well as choosing specific areas of the Rancho Seco site where the tests could be performed. Logistical details are being resolved and the Draft Test Plan for the demonstration of the On-Line Decontamination was developed, and initial comments resolved. Current plans are for the demonstrations to be scheduled for the next quarter.

For more information:

Bob Thomas, EPRI

650-855-2047

rothomas@epri.com



▼Florida International University

Objective and Scope: The FIU-HCET is working on several D&D related research projects under a grant awarded by OST. The FY2002 projects include:

- Technology Information Management and Dissemination
- D&D Technology Assessment Program
- Technology Assessment and Evaluation Facilities and Methodology Development
- Tool and Sensor Applied Research and Development
- Tool and Sensor Delivery Platform Research and Development
- Technology Deployment
- Long-term Monitoring and Stewardship for DDFA
- Aerosol Research, Development, and Modeling to Support D&D Operations

Status, Accomplishments, and Current Reporting Period Activities

Technology Information Management and Dissemination:

Development is in progress for enhanced navigation in the Gateway to Environmental Technology (GET) website. Extension to employment of handheld devices and wireless systems is being explored. Technology databases that are linked to the GET website are being updated. Since the beginning of FY2002, information on 14 technologies evaluated by HCET or the LSDDPs has been entered into the dismantlement technology database.

D&D Technology Assessment Program:

Under this project and earlier technology assessment projects funded from other sources, FIU-HCET has assessed over 100 baseline and innovative technologies for D&D application under standardized, non-nuclear testing conditions. HCET conducted an evaluation of AK Services' remote control high-pressure water system for hydrodemolition, as well as high-pressure water, low-flow-rate concrete and

concrete coating removal. A test plan and procedures were developed for evaluation of strippable and non-strippable coatings. They will be applied to the testing of NIKIMT supplied coatings. Contact persons at the DOE facilities will be enlisted for their input and involvement in the planning of HCET's technology demonstrations in FY2002.

Technology Assessment and Evaluation Facilities and Methodology Development:

In order to improve technology assessment capabilities, fifteen technology assessment/evaluation programs were identified nationwide and in other developed countries for information and approaches.

Tool and Sensor Applied Research and Development:

A sonar sensor has been tested and is ready to be integrated into the remote harsh-environment surveyor system (RHES). A list of other sensors, including cameras, has been completed, for evaluation and possible incorporation into such systems.

Tool and Sensor Delivery Platform Research and Development:

Work is continuing on the design of the crate-cutting system for the Los Alamos National Laboratory, in preparation for the 30% design review.

Technology Deployment:

The Integrated Floor Decontamination and Characterization System (IFDCS) and the Remote Hazardous Environment System (RHET) are undergoing quality assurance testing at HCET in preparation for the deployments to be held at Rancho Seco Nuclear Power Station.

Long-term Monitoring and Stewardship for DDFA:

Testing is underway on the RHES to determine the distance within which the robot can be controlled and data transmitted, and to verify the signal strength for penetration of walls within the robot's range.

Aerosol Research, Development, and Modeling to Support D&D Operations:

A paper entitled "Characterization of Aerosols Generated during the Cutting

of Metals” was presented at the American Institute of Chemical Engineers Annual Meeting in November 2001. Models are being reviewed that predict concentrations of airborne particles released under various conditions.

For more information:

<http://www.hcet.fiu.edu>

M.A. Ebadian, FIU-HCET

305-348-3585

ebadian@hcet.fiu.edu

Bob Bedick, DOE-NETL

304-285-4505

robert.bedick@netl.doe.gov

▼ **International Agreement with AEA Technology**

Objective and Scope: Through an International Agreement, AEA Technology supports DDFA by providing knowledge and expertise to address specific deactivation and decommissioning problems throughout the DOE weapons complex. AEA also provides proven technologies and systems from the United Kingdom and Europe to address site-specific problems here in the United States.

Specific activities for AEA in FY2002 have not been finalized due to delays in obtaining a final budget. However, it is planned that AEA will continue to support the FY2001 efforts for deployment of the Artisan™ Manipulator at Battelle Columbus and at Hanford, and the retention basin access and sampling effort at INEEL. Other activities that AEA may be involved in include Tank Waste Recovery at LANL, Decontamination of Large Diameter Spheres also at LANL, and Duct Decontamination at Hanford. Recently, Fluor Hanford has requested AEA assistance on a requirements-based strategic assessment of needs for processing large contaminated equipment by multiple projects at the Hanford site. Over the next ten years a number of facilities at Hanford will be undergoing decommissioning activities requiring the processing and disposal of equipment such as contaminated gloveboxes, ducts, piping, and process vessels. The Fluor Hanford Working Group

conducting the assessment will perform an alternatives analysis to investigate options for integrating the development and acquisition of capabilities to support multiple projects at the Hanford site. AEA's experience, lessons learned, and capabilities used at other DOE Sites and internationally would benefit this assessment and be considered in developing the path forward strategy.

Status, Accomplishments, and Current Reporting Period Activities:

Accessing & Sampling the Retention Basin at the INEEL Test Reactor Area

It is estimated that between one to three feet of sludge remain unevenly distributed across the base of the retention basin at the TRA facility in INEEL. In 1972, the retention basin, a below-grade concrete settling tank, 128 feet long, 40 feet wide and 15 feet deep, was found to be leaking. As the first step in the eventual removal of the tank from the ground, AEA will work with site engineers to establish the best methods of gaining entry to the basin for sampling, inspection, and retrieval of the sludge. AEA is preparing the final report, which describes the sampling and remediation options evaluated and the optimal path-forward approach recommended for sampling and remediation of the Retention Basin.

Deployment of an ARTISAN™ Manipu- lator for Debris Retrieval from a Hot Cell Facility at the Columbus Environmental Management Project (CEMP)

AEA has provided Battelle Columbus with a hydraulic manipulator mounted on a mobile platform for size reduction, decontamination, and removal of debris from the West Jefferson hot cells. The manipulator, an ARTISAN™, replaces the existing master slave manipulators, which were not designed to perform the required tasks. The ARTISAN™ has been deployed throughout Europe to perform tasks similar to those required at West Jefferson.

AEA has performed troubleshooting activities to ensure satisfactory deployment of the ARTISAN™ system at CEMP's facilities. AEA is now awaiting confirmation from CEMP on the readiness of the ARTISANTM™ to be deployed into their

hot cells. A simple deployment to retrieve an object in a CEMP hot cell is anticipated during the next few months to prove the viability of the system.

Removal of Waste from the WD

Complex at Mound

Building WD is a multi-story facility used for the treatment of low specific-activity (LSA) radioactive wastes generated by process activities at Mound. The contaminated facility is 28,800 square feet and has exterior walls of reinforced concrete and concrete block. The roof is concrete slab. As the first step in the D&D of the facility, 33 waste tanks and other miscellaneous vessels must be emptied and removed. AEA will assist Mound by deploying a small tank mixing system, previously used at Oak Ridge National Laboratory, on two tanks at the WD complex.

All installation work was completed in November and AEA completed the waste retrieval activities (i.e., approximately 1400 gallons) for the first tank in early December. Earthline was awarded a contract to connect to AEA's transfer line and put the tank waste into 85-gallon drums. A chemical additive ("WaterWorks") will be used to convert the waste into a gel form for shipment. Waste retrieval from the second tank is currently on hold pending budget decisions.

Deployment of a Hydraulic Manipulator for Hot Cell Decommissioning in Building 324 at Hanford

AEA will provide a robust, teleoperated ARTISAN™ manipulator system that has a greater reach and higher payload capacity at full extension than the baseline mechanical master slave manipulators currently in use at Hanford's 324 hot cell facility. The ARTISAN™ will be assembled to the specifications provided by the 324 Facility personnel, and will be capable of being deployed through the 324 hot cells' standard 10 inch (25.4 cm) manipulator ports, with the option of configuration to a mobile platform, if required. This hydraulic manipulator system will provide the ability to handle waste materials, deploy size reduction tooling assist

with inspection and assessments of radiological hot cells, and provide the ability to deploy radiological decontamination tooling for the 324 facility hot cells and tanks.

The final drafts of the ARTISAN™ documentation and drawings were completed and submitted to Hanford for comment. The UL certification process is complete and all documentation was received and affixed to the equipment. The final factory acceptance testing is scheduled for the second week in January 2002. Following completion, the ARTISAN™ arm will be shipped to Hanford on January 14, 2002.

For more information:

Mark Morgan, AEA Technology
703-433-0720
morgan@aeatech.com

Cliff Carpenter, DOE-NETL
304-285-4041
cliff.carpenter@netl.doe.gov

▼ Small Business Innovation Research (SBIR) Program

Objective and Scope: The SBIR Program was established in 1982 under the Small Business Innovation Development Act. The objectives of the Program are to stimulate technological innovation, use small business to meet federal research and development (R&D) needs, encourage the participation by disadvantaged and minority persons in technological innovation and increase private sector commercialization derived from federal R&D.

In December 2000, the SBIR Program was re-authorized until September 30, 2008. Congress concluded that the SBIR program was successful in providing small businesses with opportunities to compete for federal R&D awards and that the SBIR had effectively stimulated commercialization of the resulting technology, benefiting both private and public sectors.

SBIR programs fund R&D efforts of a high-risk nature that have high commercial potential. Under the Small Business Innovation Development Act, each agency with an extramural R&D budget in excess

of \$100 million must establish an SBIR Program.

The SBIR Program is a three-phase process. Phase I is based on proposals submitted in response to solicited research topics by participating agencies. The purpose of Phase I is to evaluate and demonstrate the scientific and technical merit and feasibility of an idea. Phase I proposals describe the projected results of the proposed research, the approach to be used and how it will prove the feasibility of its approach. Phase I research efforts are typically six months in duration and awards normally do not exceed \$100,000.

Companies that successfully complete Phase I can compete for Phase II funding to expand on Phase I results and continue development of the technology. Phase II is the principal R&D effort, generally lasting 24 months. Awards typically do not exceed \$750,000.

Status and Accomplishments:

The current Phase I projects include:

- (1) Aspen Systems, Inc., Personal Cooling System
- (2) Radiation Monitoring Devices, Inc., A High Sensitivity Beta Imaging System for Surface Assessment
- (3) YAHSGS LLC/Oak Ridge National Lab, Total Online Access Data System
- (4) Physical Optics Corporation, An Advanced Real-Time Data Management System

The current Phase II projects include:

- (1) ARM Automation, Inc., Modular Robotics for Delivering On-Site Contamination Sensors and Mapping System to Difficult-to-Access Locations
- (2) AUTOMITIKA, Inc., PipeTaz: Automated Pipe Asbestos Insulation Removal System
- (3) ADA Technologies, Inc., Portable Multicontaminant Detection Instrumentation for R&D
- (4) Intelligent Optical Systems, Inc., Intelligent Unmanned Monitoring of Remediation Sites
- (5) X-Ray Optical Systems, Inc., Compact Polycapillary Based Microbeam X-Ray Fluorescence Analysis System for Remote Monitoring of Metal Contamination

- (6) Radiation Monitoring Devices, Inc., An Advanced Avalanche-Photodiode Based Spectroscopic Radiation

- (7) Photon Imaging Inc., Portable XRF System

Current Reporting Period Activities:

Pipe-Taz: Automated Pipe Asbestos Insulation Removal and Processing System: Automatika, Inc., is currently finishing the detailed system design and expects to begin fabrication in early 2002. Automatika, Inc., is actively pursuing commercialization of the system with an abatement contractor partner.

Modular Robotics for Delivering On-Site Contamination Sensors and Mapping System to Difficult-to-Access Locations: The cart system and subsystem components are now undergoing various phases of specification, procurement, build and even some testing. Recently completed items include: laser range-finding tool and supporting software, CCD camera selection, Pan/Tilt camera positioner and software interface, joystick controller for cart/robot/camera and the specification of the mobile platform unit with its power supply. The robot arm itself is undergoing further refinement and one new, larger actuator module size is being designed. SRS personnel have earmarked a former Nuclear Physics Lab as a demonstration site.

An Advanced Avalanche-Photodiode Based Spectroscopic Radiation: An examination of the discrete components required for implementation and package design issues has been started is now well underway. Several discrete-component readout scheme variants have been modeled and plans to assemble preliminary circuitry have begun. Radiation Monitoring Devices, Inc. (RMD) is also adapting an APD signal processing APD and ASIC for use in this project. It is a highly compact preamp, shaper, sample-and-hold, and trigger ASIC that has been designed for use with APD arrays.

The ASIC circuitry has moved into beta testing and RMD has found some problems related to its performance. When signals are input from the APD, the preamplifiers of the device short out. These high-amplitude signals seriously damage the ASIC device and destroy the input preamplifier channels. RMD is currently working on protecting the inputs of the ASIC with diode clamps and

Zener diodes to ground.

The diode-backed arrays are scheduled for fabrication. Designs have been finalized for fabrication and assembly and the devices will be ready shortly. RMD will begin mounting of APD arrays to a ceramic substrate for joining with external circuitry. This ceramic substrate will be highly complex as it has to support many high-voltage interconnections, signal leads, and ground leads, all within a very small package. Aperture design and system housing design is well under way and will be released to the machinist shortly.

Portable XRF System: X-Ray Optical Systems, Inc. (XRO) has developed and tested three silicon drift detector (SDD) spectrometer packages, based on getter pump technology as an integrated device including low noise preamplifier and thermal cooling systems, which requires no ion pump and water cooling thus suitable for direct hooking up with conventional XRF systems. Extensive tests using X-ray test bench and an XIA Digital X-ray Processor (DXP) have demonstrated their excellent resolution (150-250 eV) @ 5.9 keV (peaking times 6-0.25 microseconds) and throughput (up to 300 kcps at ~60% dead time) at short peaking times.

XRO has designed an integrated SDD power/bias supply and XIA Digital Pulse Processor electronics, which will be ready for assembly and testing by the middle of the first quarter of 2002.

XRO has started software design to interface with XIA Digital Pulse Processors for XRF applications. The software framework and the communication part with the XIA hardware was designed and tested.

For more information:

*Vijendra Kothari, DOE-NETL
304-285-4579
vijendra.kothari@netl.doe.gov*

▼ Technology for Real-Time Measurement of Surface and Airborne Beryllium

Objective and Scope: The objective of this contract is to develop, test, and demonstrate an innovative real-time monitor for surface and airborne beryllium. This field-portable device is based on Laser-Induced Breakdown Spectroscopy (LIBS) and will be applicable to continuous air monitoring, field analysis of filters from personal air monitors, and analysis of surface wipe samples. Another potential application is a point and shoot device for direct measurement of beryllium on a surface. Accurate and timely detection and monitoring of beryllium is critical to worker safety during deactivation and decommissioning activities. Beryllium dust is a significant workplace hazard. Exposure to beryllium particles can cause chronic beryllium disease (CBD), an irreversible and sometimes fatal scarring of the lungs, in certain people. Beryllium metal has been produced for various industrial uses and has been widely used in aerospace and defense applications. The baseline method for beryllium analysis is sending samples to an off-site laboratory, which may require days or weeks to obtain results. RFETS, ORNL, Y-12, LANL, and DoD have beryllium issues.

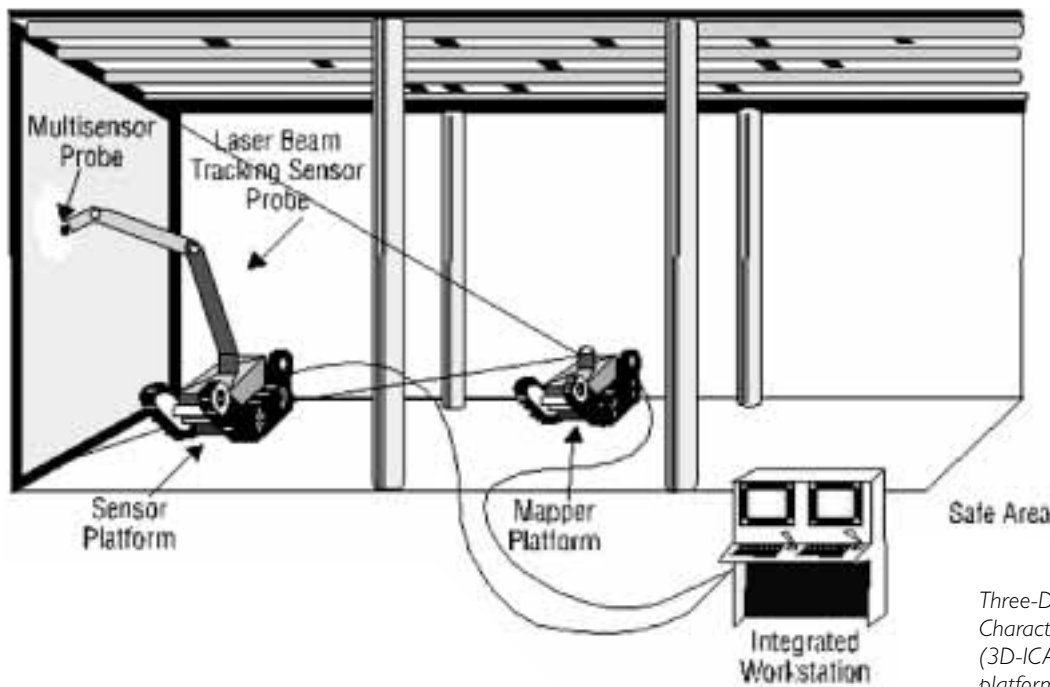
Status and Accomplishments: On September 30, 2000, a contract was awarded to Science Engineering and Associates (SEA) to develop a technology for Real-Time Measurement of Airborne and Surface Beryllium. The contractor has been working to establish lines of communication with RFETS, where demonstration of the instrument is planned. Following minor revisions to the Scope of Work, a subcontract was issued to Lovelace Respiratory Research Institute (LRRI). Under this subcontract, LRRI will prepare various beryllium on-filter samples for SEA, provide laboratory space at the LRRI facility for SEA to conduct LIBS measurements of beryllium filters, and provide consultation related to the design of the beryllium monitor. The SEA design staff held its first design meeting where the conceptual design for the prototype monitor was defined. Slight refinements to the conceptual instrument design were made to incorporate the input from the RFETS technical contacts.

Current Reporting Period Activities:

The prototype beryllium monitor was transported to LRRI to conduct the final testing for system calibration. The initial set of samples was run for the continuous air monitor (CAM) mode of operation and the calibration results indicate that the system is performing very well. For this calibration, the prediction model was

2.2

FACILITY CHARACTERIZATION



Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS) is a remote mapper and sensor platform to use in contaminated areas.

developed with only three calibration samples, and then it was used to predict a suite of samples not previously seen by the calibration model.

In actual use, the calibration procedures and results differ between the wipe and CAM functions. For the wipe samples, the limits are established based upon a mass of beryllium/wipe. For the CAM mode, however, the pump time can be altered to fit the instrument dynamic range with the action limits for beryllium concentration in air. For example, SEA plotted the beryllium-CAM performance as a function of pump time, for ten minutes and 15 minutes with respect to the RFETS action limit and the NETL detection limit. The 15-minute pump time provided a more conservative operating condition, such that the calibration levels are well below the action and detection limits established. The detection level of the instrument has not been formally established, but it will be orders of magnitude lower than the lower calibrated limit. Since the filters are sampled with several thousand sparks, picogram levels per spark detection are being observed.

SEA continued to work with RFETS on the procedures for the field demonstration. The Draft Test Plan including field procedures has been submitted to NETL and RFETS for review and comment. In discussions with RFETS, it was mutually agreed that trying to demonstrate between Thanksgiving and Christmas would be difficult with all of the planning required. Thus, the decision was made to conduct the test in early January. Since the submission of the draft Test Plan, it was suggested by RFETS that it would be better for them if the wipe tests were conducted at the SEA facility. If this testing went well, then the second round of testing would occur at the RFETS facility. One of the primary considerations was that RFETS does not have "clean" areas that they would want to bring beryllium into for testing, and they feel that once the instrument is brought to RFETS into a beryllium-contaminated zone for the CAM testing, there is a high probability (if not a certainty) that the instrument would not be allowed to leave the site. This leaves the possibility that the monitor would not be exposed to enough airborne

beryllium to make an adequate determination on performance. Thus, SEA will work with RFETS to change the plan and conduct the preliminary work at LRRI in Albuquerque and the second test will be for CAM operation, but will also be for training of RFETS personnel on the use of the instrument so that they can test the system over many months. This approach will most likely allow the first test to be conducted in early January, then the second test in early February to complete the program. SEA must also conduct testing at Pantex at the end of January on the other hardware development effort under a separate contract with Pantex.

In the next two months, SEA will finalize all calibration of the instrument, alter the field procedures to reflect the desire to conduct the wipe test at LRRI, and conduct the first round of field tests. In addition, SEA will produce a draft final report for submission at an agreeable time based on the new demonstration dates.

For more information:

Tech ID 2914

*Steven Saggese, SEA
619-294-6982
sjsaggese@sci.seabase.com*

*Ron Staubly, DOE-NETL
304-285-4991
ron.staubly@netl.doe.gov*

▼ Technology Deployment for Asbestos Destruction

Objective and Scope: Asbestos Recycling Incorporated (ARI) was awarded a contract to process 10,000 pounds of asbestos containing material (ACM) from SRS. ARI's thermochemical treatment unit consists of modular components designed for hazardous waste treatment. The system will be used to remineralize asbestos resulting in non-toxic, non-regulated, asbestos-free aggregate suitable for recycling. The modular systems include a waste pretreatment system, a rotary hearth, an off-gas processing system, and a product-handling system. These systems are designed to accommodate a variety of waste types and contaminants.

Status and Accomplishments: The contract was awarded to ARI on September 30, 2000. On October 20, 2000, NETL held a project kick-off meeting that included a presentation from ARI describing the technology to be used, the scope, the schedule, and other pertinent aspects of the project. In early October 2000, ARI coordinated with DOE's Savannah River complex and DOE's asbestos abatement contractor to arrange for abated asbestos to be picked up by ARI's selected trucking contractor. ARI contracted with Freehold Cartage, Inc., Eutawville, South Carolina, to pick up the asbestos and transport the material to ARI's facility located in Tacoma, Washington. During this time, ARI also secured a permit from the Puget Sound Air Quality Agency that allows temporary storage of the asbestos pending the issuance of a final and permanent permit.

The asbestos was loaded onto the Freehold Cartage truck on October 18, 2000 and was transported without incident to Tacoma on October 23, 2000. The 441 bags of asbestos were unloaded into a steel shipping container, which was then properly labeled and locked. The asbestos will remain in storage until processed.

Status and Accomplishments: ARI has assembled the thermochemical conversion unit that will destroy the Savannah River Site asbestos waste at their Tacoma facility. The site preparation activities for the demonstration are complete. ARI experienced some delays in the shakedown testing during the

month of December 2001. As a result, ARI requested a three-month extension until the end of March 2002.

For more information:

*Dale Timmons, Asbestos Recycling Inc.
206-575-9700
dtimmons@hermanson.com*

*Cliff Carpenter, DOE-NETL
304-285-4041
cliff.carpenter@netl.doe.gov*

2.3

FACILITY DECONTAMI- NATION

2.4

FACILITY DISMANTLEMENT AND MATERIAL DISPOSITION

▼ Robotics Crosscutting Program

Objective and Scope: The Robotics Crosscutting Program (Rbx) supports the DDFA through design and integration of remote systems and capabilities used for near-term facility deactivation and ongoing surveillance and maintenance activities with extended application to final facility decommissioning. Deployment of remote D&D systems will reduce worker exposure to hazardous environments and provide productivity increases leading to substantial cost savings. Rbx also provides the technical interface for ongoing activities conducted by NETL Industry Programs, the University Research Program in Robotics (URPR), and EMSP in the area of remote/robotic systems development.

During FY2002, the Rbx D&D Product Line will focus on incorporating applicable research results from other DDFA-funded research projects into the development of telerobotic manipulation systems targeted for field deployment. Telerobotic manipulation systems are the next generation technical solution to remote manipulation problems that currently rely on purely teleoperated task execution. Telerobotic manipulation systems allow computer-controlled execution of portions of the manipulation task, increasing task execution efficiency. In particular, the Rbx D&D Product Line will develop and evaluate candidate control technology components applicable to telerobotic manipulation systems and develop,

demonstrate, and deploy specific telerobotic manipulation systems.

Status, Accomplishments, and Current Reporting Period Activities:

Rbx staff have been reviewing the FY2001 demonstration activities where a Schilling manipulator coupled with a plasma torch was used to cut flat plates and structural angle iron. The purpose of this review is to determine requirements for smart tooling sensor-based telerobotics techniques that will be integrated into the Telerobotic Manipulation System (Tech ID 2181) in FY2002. Sensor-based telerobotic techniques could be used to further improve task completion times, further increase the ability to cut more complex structural elements such as I-beams and large pipes and vessels, and decrease the operator expertise levels required to complete those tasks remotely.

Progress continues on the design efforts for the prototype PC104 Schilling Controller. The goal is to design a controller that is less complex and less costly to manufacture. The Rbx staff is also designing force/torque-sensing capabilities into the controller. Though most fielded Schilling manipulators do not currently have functional force/torque sensors, the future need for such capability is considered to be high for telerobotic applications. Thus, addition of force/torque sensing will be the only major change to the PC104 controller. Finalization of the design and prototype is expected by the end of December; commercialization is targeted for the end of January. The Rbx staff has also been in contact with Pacific Northwest National Laboratory (PNNL) and Cybernetix in an attempt to define interfaces so that a PC104 controller similar in function to the Schilling Titan controller could be implemented. This could provide enhanced control capability for the Hanford Pit Viper system if successful.

Commercialization efforts for the compact remote console, which began in late FY2001, are quickly coming to fruition. Agile Engineering has completed the first unit and has shipped it to Hanford.

For more information:

*Dennis C. Haley, DOE-ORNL
865-576-3965
haleydc@ornl.gov*

Pit Viper Cybernetix manipulator system



▼ **Electro-Hydrostatic Transmission and Control Technology for Modular D&D Manipulators**

Objective and Scope: Remote D&D operations demand manipulators that can accommodate heavy payloads and generate high forces. In spite of their many drawbacks, hydraulic systems are currently used. Automation requirements unique to DOE demand use of modular architecture and a system of pre-engineered actuators and links that can be quickly combined to create a manipulator tailored to specific tasks with the capacity to handle heavy payloads. The objective is the development of a manipulator that uses electro-hydrostatic control and actuators. The manipulator's actuator module will have torque density significantly higher than current technology. In Phase I, control algorithms for electro-hydrostatic actuators will be developed and proven on a test-bed to verify the feasibility of the approach. In Phase II, a complete integrated electro-hydrostatic actuator (EHA) will be designed, fabricated, and tested. In Phase III, the complete integrated EHA will be tested at a DOE field site. The contract is based on the first two phases, with the third phase optional.

Status and Accomplishments: The contract was awarded to ARM Automation, Inc. on September 28, 2001.

Current Reporting Period Activities: A kickoff meeting was conducted on October 29, 2001. A preliminary survey of all hydraulic transmissions has been initiated. To date, more than 40 manufacturers have been contacted with regards to their product literature. The system modeling software has been procured. This software will be used to model the non-linear EHA. The test bed has been designed and is being constructed.

For more information:

Tech ID 3165

*Joseph W. Geisinger
ARM Automation, Inc.
281-228-5409
joewg@armautomation.com*

*David L. Schwartz, DOE-NETL
412-386-6714
david.schwartz@netl.doe.gov*

▼ **Transmission-Based Electrical Servoactuators**

Objective and Scope: The project objective is to develop and test transmission-based electrical servoactuators (TBAs) to extend the operating range of electrical servoactuators and demonstrate their commercial viability. The work will focus on D&D applications. Many D&D projects will use robotics and remote handling systems, especially when radiation exposure levels are high. Such systems may also be used to reduce labor costs in highly repetitive operations. Because of the low power and torque density of common electrical servomotors, systems in the payload range required by D&D are almost always implemented using electrohydraulics. While servoactuators used in hydraulic manipulators have much greater power density, they introduce much higher complexity and cost throughout a system's life cycle, which has a direct impact on EM project costs.

The goal of this applied research project is to achieve significant increases in the power-to-weight ratios of the electrical servoactuators so they can be used on future remote manipulator systems. The fundamental idea is to incorporate a multi-speed transmission to "spread" a servomotor's torque-speed characteristics across a wider output speed range. This has the effect of allowing smaller, high-power electrical motors to also deliver high torque at low speeds. By using a multi-speed transmission similar to common practice in automobiles, the motor size can be reduced dramatically while increasing overall power to weight ratio in the process. The fundamental research challenges are believed to be associated with transmission miniaturization and the achievement of smooth servo control during transmission ratio variations. Successful research results

would allow electrical servoactuators to be used in virtually every application required in environmental cleanup projects ultimately resulting in increased reliability, enhanced maintainability and reduced equipment costs. Phase I of the project will assess the basic feasibility of transmission-based electrical servoactuators. In Phase II, a pre-commercial prototype will be developed and tested.

**Status, Accomplishments, and
Current Reporting Period Activities:**

The project was initiated in October 2001 and a project kick-off meeting was conducted at NETL on December 3, 2001. Initial efforts have focused on conceptual design work including development of detailed baseline requirements for a prototype in consultation with the Rbx at ORNL. An extensive survey of the technical literature on power transmissions including continuously variable transmissions (CVTs) was conducted and a survey of commercial products involving CVTs and other types of transmissions is continuing. A dynamic simulation of a single axis fixed gear ratio manipulator has been completed and is being used as the foundation for subsequent TBA models and simulations.

For more information:

Tech ID 3170

*William R. Hamel
University of Tennessee
865-974-5274
whamel@utk.edu*

*David Szucs, DOE-NETL
412-386-4899
szucs@netl.doe.gov*

▼ Protective Clothing Based on Permselective Membrane and Carbon Absorption

Objective and Scope: Membrane Technology and Research (MTR), Inc., was to develop and demonstrate improved protective clothing that provides protection equivalent to current garments, but that was lighter weight to improve comfort and breathable to allow water vapor to escape, therefore reducing heat stress. Improved protective clothing was to be made of an innovative ultra-thin, permselective outer membrane. The membrane was to be extremely permeable to water vapor escaping from the wearer, but highly impermeable to hazardous compounds. Fabric properties were to be optimized and prototype suits tested during Phase I. In Phase II, 30 or more suits were to be fabricated and used in a variety of extensive, comparative trials in the laboratory and at a non-hazardous site.

Status and Accomplishments:

The Phase I development of fabric materials and laboratory tests on the fabric has been completed. In laboratory tests, water vapor transmission rates of 600x900 g/m²/day have been measured through the fabric. This water vapor transmission rate was far superior to butyl rubber suits with a water vapor transmission rate of 0x10 g/m²/day. Chemical vapor transmission rates were equal to or lower than rates for the fabrics of commercial suits.

In other tests, Uretex laminated two rolls of the fabric. One roll of fabric (90 meters by 30 inches), MTR1, used rip-stop nylon as both inner and outer layers, and the second roll (40 meters by 30 inches), MTR2, used the rip-stop nylon on the outside and a flexible, lightweight, non-woven fabric on the inside. The prototype suits manufactured by Kappler Systems received the following tests by outside laboratories: chemical permeation, physical properties, sweating mannequin, and heat stress modeling. In general, the results were not as good as expected. Although the fabrics did combine water permeability and reduced heat stress with chemical protection, neither the chemical permeation resistance nor the reduc-

tion in heat stress was as high as hoped. The economic analysis was updated based on this new data. The analysis showed that MTR1 provides the greatest benefits in productivity; however, the benefit does not appear to justify the higher cost of the suit made of this fabric. MTR2 fabric had less productivity benefit and a higher selling price, and so was less attractive than MTR1.

The Phase II permselective garment testing by the International Union of Operating Engineers (IUOE) was concluded during the summer of 1999. The garments tested for personnel comfort and well-being were those assembled by MTR's potential commercialization partner from the permselective fabrics supplied by MTR, Tyvek, and non-breathable garments like Saranex. The garments were all full bodysuits with hoods (for comparison purposes), and contained a more spacious cut in the chest and waist/crotch area than other manufactured garments, and this was very noticeable and appreciated by the test personnel. This also helped the garments to be more durable. Examples of tasks performed include crawling through confined spaces, performing metal grinding, and loading and hauling material in a wheelbarrow. In general the MTR garments were as comfortable with respect to heat-stress as the Tyvek garments, and were much more comfortable than the non-breathable garments. The test personnel all had very good comments concerning the MTR garments.

Current Reporting Period Activities:

The MTR permselective membrane material development project has concluded as of the fall of 2001. The final report indicated that the MTR, Inc.-developed permselective membrane fabrics provide liquid splash protection while allowing for perspiration release through the garment. During Phase II, the permselective fabric manufacturing steps were significantly simplified, resulting in a 30 percent reduction in manufacturing costs. Permselective membrane protective suits were prepared in collaboration with

2.5

WORKER SAFETY AND OTHER PROJECTS

An innovative fabric combines an ultrathin, permselective outer membrane with a sorptive inner layer.



MTR's potential commercialization partner and heat stress testing with human test subjects was conducted by IUOE. The IUOE tests confirmed that the MTR protective fabric is significantly more comfortable than non-breathable materials. The life cycle costs for the MTR permselective protective fabric compared very favorably with polyvinyl chloride and Saranex/Tyvek coveralls. These costs are dependent upon garment cost, reuse, decontamination, maintenance, storage, and disposal. Using the MTR suit twice before disposal results in a total-cost-per-productive-hour of \$25.90, which is a very significant savings over the Phase I economic analysis and similar splash protective garments (the final report provides more details). Along with the detailed economic analysis that was performed, market opportunities were identified for the novel MTR membrane protective fabric: (1) liquid splash protective clothing for hazardous waste site operations; (2) liquid splash protective clothing for emergency response; and (3) Class 3 NFPA 1994-compliant protective clothing for civilian use during chemical terrorism incidents. In addition, presently MTR's collaborative partner is not proceeding with commercialization of the MTR permselective protective fabric, and it is unknown whether or not they will.

For more information:

Tech ID 95

*Hans Wijmans, MTR, Inc.
650- 328-2228, ext. 188
wijmans@mtrinc.com*

*Harold Shoemaker, DOE-NETL
304-285-4715
harold.shoemaker@netl.doe.gov*

The Office of Science and Technology (OST), as part of DOE's Office of Environmental Management (EM), manages a national program to conduct basic and applied research, and technology development/demonstration/deployment that is essential to completing a timely and cost-effective cleanup of the DOE nuclear weapons complex. OST provides environmental research results, as well as cleanup technologies and systems to meet EM program high priority science and technology needs while reducing technological risks and cost of implementation of effective solutions. The OST works closely with both the Office of Site Closure (EM-30) and the Office of Project Completion (EM-40) to accomplish its mission.

To achieve a comprehensive, integrated approach to developing and providing science and technology solutions, EM has separated the site cleanup needs into a set of five problem areas. A Focus Area has been established to plan and manage EM's research and development investments to develop solutions to each of these five problem areas:

- Deactivation & Decommissioning Focus Area
- Tanks Focus Area
- Nuclear Materials Focus Area
- TRU and Mixed Waste Focus Area
- Subsurface Contaminant Focus Area

In addition, three crosscutting technology areas were established where technology needs and targets are relevant to more than one Focus Area:

- Characterization, Monitoring and Sensor Technology (CMST)
- Efficient Separations and Processing (ESP)
- Robotics

The Industry Program conducts competitively selected activities that involve the private sector in developing, demonstrating, and implementing improved technologies that address the needs of the focus areas and the crosscutting areas.

The result of this structure of programs is that the D&D Focus Area is positioned to support those research areas defined as highest priority by EM-50 and DOE customers.

▼ The Role of NETL

The Federal Energy Technology Center, with physical sites in both Pittsburgh, Pennsylvania and Morgantown, West Virginia, was designated as the National Energy Technology Laboratory (NETL) in December 1999. As the 15th national laboratory, NETL becomes part of the national laboratory research system. This is the largest research system of its kind in the world with more than 30,000 engineers and scientists conducting research and research and leading-edge experiments. As part of this system, the new National Energy Technology Laboratory will join Argonne National Laboratory (Illinois); Brookhaven National Laboratory (New York); Lawrence Berkeley National Laboratory (California); Fermi National Accelerator Laboratory (Illinois); Idaho National Engineering & Environmental Laboratory (Idaho); Lawrence Livermore National Laboratory (California); Los Alamos National Laboratory (New Mexico); National Renewable Energy Laboratory (Colorado); Oak Ridge National Laboratory (Tennessee); Pacific Northwest National Laboratory (Washington); and Sandia National Laboratories (New Mexico and California).

Rita A. Bajura, NETL Director, a career federal executive with more than 20 years experience in government-industry energy partnerships, continues in her leadership position as head of the single management team that serves both physical sites with a combined working force of more than 530 federal scientists, engineers, and administrative staff. NETL is responsible for nearly 600 research projects; most involving the development of advanced fossil fuel technologies.

The new national laboratory's core capabilities include the Center for Advanced Natural Gas Studies and the National Petroleum Technology Office (NPTO) in Tulsa, Oklahoma.

Senator Robert C. Byrd (D-WV) remarked in the course of the dedication that, "Much of the laboratory's work is dedicated to the worthy goal of developing innovative, clean and efficient technologies that will allow our nation to meet its growing energy needs."

3.0

PROGRAMMATIC STRUCTURE AND ORGANIZATION

As the nation's newest national laboratory, it will continue to help light a pathway for a new era of energy use that will ensure a comfortable standard of living for our children and our children's children."

NETL also manages a significant portion of the technology development needed to clean up sites in the government's nuclear weapons complex. In February 1995, the then Morgantown Energy Technology Center was selected by EM-50 to be the implementing organization for the D&D Focus Area. As such, it brought the experience gained from being the implementing organization for the Industry Program, which competitively selects industrial R&D performers through Research Opportunity Announcements (ROAs) and Program Research and Development Announcements (PRDAs). As the lead organization for D&D implementation, NETL is responsible for the planning, monitoring, and evaluating research development demonstration testing and evaluation (RDDT&E) projects to meet the requirements of EM-50 and its customers in EM-30.

"Much of the laboratory's work is dedicated to the worthy goal of developing innovative, clean and efficient technologies that will allow our nation to meet its growing energy needs."

Senator Robert C. Byrd (D-WV)

▼ **Stakeholder Feedback**

The stakeholders in the Deactivation and Decommissioning Focus Area (DDFA) include DOE headquarters; DOE operations offices; DOE sites and their operating contractors; DDFA technology developers and users in the private sector; federal, state, and local regulators; and the communities around affected DOE facilities. These stakeholders have been providing input to focus area planning and implementation; program contacts are provided on the first page of this report.

4.0

BACKGROUND

The D&D Focus Area was established to develop and demonstrate improved technologies and systems that could solve customer-identified needs to characterize, deactivate, survey and maintain, decontaminate, dismantle, and dispose of or recycle DOE surplus facilities and their contents. The mission also includes facilitating the acceptance, approval, transfer, commercialization, deployment, and implementation of these technologies and systems.

These technologies are needed to address the pressing needs of deactivating more than 7000 contaminated buildings and decommissioning more than 700 buildings. In addition, material disposition is required for over 600,000 tons of metal and 23 million cubic meters of concrete in contaminated buildings and for 400,000 tons of metal currently in scrap piles. The major drivers for this focus area are the high safety and health risks associated with working in aged and contaminated facilities and the high costs associated with facility deactivation, surveillance, and maintenance using currently available baseline technologies.

▼ D&D Focus Area Strategy

Subsequent to the selection of NETL as the lead organization for the D&D Focus Area, a program review of all FY95 projects was held in May 1995. Based on this and other recent program reviews, as well as the general requirement for fiscal constraint throughout, the following strategies were developed:

▼ Programmatic Strategy

- ◆ Focus D&D technology development program on large-scale demonstrations emphasizing full-scale demonstrations using a suite of improved technologies.
- ◆ Demonstrate technologies only through large-scale demonstrations.
- ◆ Focus on technologies that are identified as high priority by customers, that have wide applicability, and that have a commitment to be considered for use by customers.

- ◆ Emphasize demonstration and deployment of private-sector technologies.

- ◆ Technical Strategy

In the near term, emphasize technologies to effectively support:

- ◆ deactivation of facilities,
- ◆ decontamination of surfaces,
- ◆ reuse of bulk contaminated materials, and
- ◆ application of remotely operated dismantlement systems

In the middle term, emphasize technologies to effectively support:

- ◆ applications of remote surveillance systems,
- ◆ characterization of volumetrically contaminated materials,
- ◆ decontamination of bulk materials, and
- ◆ adoption of release standards for bulk contaminated materials.

▼ Large-Scale Demonstrations and Deployment Projects

A cornerstone of the D&D Focus Area is its series of large-scale demonstration and deployment projects. The LSDDPs demonstrate innovative and improved D&D technologies at full scale, side by side with existing commercial technologies. The intent is to compare benefits from using a suite of improved and innovative D&D technologies against those associated with baseline D&D technologies. This approach provides an opportunity to test improved and innovative D&D technologies at a scale that will provide meaningful cost and performance information to the potential end-users of the technology.

5.0

UPCOMING EVENTS

▼ May 2002

IEEE International Conference on Robotics Automation

May 11–15, 2002
Washington, DC

▼ June 2002

ANS Annual Meeting — The Revival of the Nuclear Power Option

June 9–13, 2002
Hollywood, FL

▼ August 2002

Spectrum 2002 Conference on Nuclear and Hazardous Waste Management

August 4–8, 2002
Reno, NV
www.ans.org/spectrum

We list conferences and workshops of interest to our readership.
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*Contact: Danielle Blair
Science Applications International Corp. (SAIC)
304–598–3709
danielle.m.blair@saic.com*

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6.0

ACRONYMS

3D	Three Dimensional
3DICAS	Three Dimensional Integrated Characterization and Archiving System
ACM	Asbestos Containing Material
ACS	Advanced Characterization System
AEAT	AEA Technology
ALARA	As Low As Reasonably Achievable
APP	Automated Plutonium Processing
ARI	Asbestos Recycling Incorporated
ASME	American Society of Mechanical Engineers
ASTD	Accelerated Site Technology Deployment
BGD	Below-Grade Duct
BGRR	Brookhaven Graphite Research Reactor
BN	Bechtel Nevada
BNFL	British Nuclear Fuels
BNL	Brookhaven National Laboratory
CAEM	Continuous Air and Emission Monitoring
CAM	Continuous Air Monitor
CBD	Chronic Beryllium Disease
CDI	Canyon Disposition Initiative
CEM	Continuous Emission Monitoring
CEMP	Columbus Environmental Management Project
CLE	Contaminated Large Equipment
CLR	Coherent Laser Radar
CMST	"Characterization, Monitoring and Sensor Technology"
CP-5	Chicago Pile 5
CRC	Compact Remote Console
CSI	Cambell Scientific Incorporated
DDFA	Deactivation and Decommissioning Focus Area
DoD	Department of Defense
DOE	Department of Energy
DVRS	Decontamination and Volume Reduction System
EM	Environmental Management
EMS	Excavation Monitoring System
E-PERM	Electret-Passive Environmental Radiation Monitor
EPRI	Electric Power Research Institute
ESH	"Environment, Safety, and Health"
ETF	Effluent Treatment Facility
EVS	Environmental Visualization System
FEMP	Fernald Environmental Management Project
FIU	Florida International University
FIU-HCET	Florida International University's Hemispheric Center for Environmental Technologies
FSB	Fuel Storage Basin
FY	Fiscal Year
GLD	Gamma Locator Device
HAMMER	Hazardous Materials Management and Emergency Response Training and Education Center
HCET	Hemispheric Center for Environmental Technologies
HEPA	High Efficiency Particulate Air
HFBR	High Flux Beam Reactor
HSGC/MS	High-Speed Gas Chromatography/Mass
HVAC	"Heating, Ventilation, and Air Conditioning"
IC	Integrated Contractor
IECS	Integrated Excavation Control System
IID	Isotopic Identification Device
IMMS	Improved Measurement and Monitoring System
INEEL	Idaho National Environmental and Engineering Laboratory
ISOCS	In Situ Object Counting System
ISSRS	In Situ Size Reduction System
ITRD	Innovative Treatment and Remediation Demonstration
ITSR	Innovative Technology Summary Report
IUOE	International Union of Operating Engineers
LANL	Los Alamos National Laboratory
LARADS	Laser Assisted Ranging and Data System

LIBS	Laser-Induced Breakdown Spectroscopy
LLNL	Lawrence Livermore National Laboratory
LRAD	Long Range Alpha Detector
LRRI	Lovelace Respiratory Research Institute
LSA	low specific activity
LSC	Liquid Scintillation Counting
LSDDP	Large Scale Demonstration and Deployment Project
LTC	"LTC Teletrak, Inc."
LTS	Long Term Stewardship
MAES	Mechanical and Aerospace Engineering and Engineering Science
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MEMP	Miamisburg Environmental Management Project
MOU	Memorandum of Understanding
MTR	Membrane Technology and Research
MVS	Molecular Vibrational Spectrometer
NETL	National Energy Technology Laboratory
NMR	National Center of Excellence for Metals Recycling
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
OSDF	On-Site Disposal Facility
OST	Office of Science and Technology
PCA	Principle Component analysis
PCB	Polychlorinated Biphenyl's
PFT	Perfluorocarbon Tracer
PNNL	Pacific Northwest National Laboratory
PPPL	Princeton Plasma Physics Laboratory
PuSPS	Plutonium Metal and Oxide Processing System
QA/QC	quality assurance/quality control
R&D	Research and Development
Rbx	Robotics Crosscutting Program
RCRA	Resource Conservation and Recovery Act
RCT	Radiation Control Technician
RFETS	Rocky Flats Environmental Technology Site
RFI	Rocky Flats D&D Initiative
RL	Richland
R-MAD	Reactor Maintenance Assembly and Disassembly
ROSRS	Remote Operated Size Reduction System
RTSA	Robotic Task Scene Analysis
SAMMS	Self Assembled Monolayers on Mesoporous Supports
SBIR	Small Business Innovation Research
SCO	Surface Contaminated Objects
SEA	Science Engineering and Associates
SOW	Statement of Work
SRS	Savannah River Site
SWB	Standard Waste Box
TAN	Test Area North
TMS	Telerobotic Manipulation System
TRA	Test Reactor Area
TRU	Transuranic
TSDS	Technology Safety Data Sheet
TTP	Technical Task Plan
TWR	Tank Waste Retrieval
UDP	Universal/Demolition Processor
UL	Underwriters Laboratory
URPR	University Research Program in Robotics
UTK	University of Tennessee Knoxville
VACIS	Vehicle and Cargo Inspection System
WAC	Waste Acceptance Criteria
WBS	Work Breakdown Structure
WIC	Waste Isolation Composite
WIPP	Waste Isolation Pilot Plant
XRF	X-Ray Fluorescence